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The Value of Counsel.

Many a king has lost his head who would have retained it upon his shoulders if there had been someone about him with the courage and the chance to speak the plain truth, and many a manufacturer has failed for precisely the same reason. There are many owners of manufacturing establishments who cannot bear to think that any ideas but their own are good for anything in the conduct of their business and who, by a process of natural selection, gather about themselves a set of men who have no ideas of their own, don't want to have any, believe that their own interests will be best served by sycophancy or "ready acquiescence with the ideas of the old man" and never speak to him otherwise than in flattery or humble adulation. If the "old man's" ideas are all right, this does not work so very badly, but if they are wrong, in whole or in part, there is no check upon them, nor any tendency within the establishment itself to correct wrong things.

How often do we see a shop proprietor who is an adept in the art of meeting and dealing with customers, but who does not get along well with his employees. This is usually not because his customers are a different sort of men, but because a customer, being usually quite independent, is free to express his opinion and freely does so when he thinks he is not properly treated, and sometimes takes his custom elsewhere. In other words, a man who has no natural tact or perhaps little disposition to consider the rights or feelings of others is soon taught by his customers to regard these things so far as they are concerned, but his employees usually have no such opportunities, and yet by bad relations with his employees a manufacturer may lose as much as by bad relations with his customers. There is usually a decided advantage in one's having an associate who dares to speak his mind freely and who has a right to do so. When such an associate is not provided for by the organization of the business its head must depend upon the chance man who can do it, or must suffer for the lack of such a man.

Corporations usually have an advantage in this respect. Their organization gives to more than one man the right and the duty to hold views and express opinions regarding the conduct of the business, especially when no one man owns sufficient of the stock to enable him to dominate all other stockholders.

A very prominent publishing house failed a while ago, and those familiar with its affairs declared that one of the chief reasons for its decline was that a man who dominated it chose to be so grumpy and disagreeable with authors that all the best ones kept clear of him and his house got only the leavings of others, and very little of the best work. He needed a man who could talk plainly to him, or the house needed a new man in his place. Failing in both these, the house failed. In manufacturing lines especially, but in all other lines of business in greater or less degree, the man who guides the destinies of any large business needs the counsel of others, needs to know how they regard matters of policy from their more or less different standpoints, and it is safe to say that no man can be himself so able as to make the ideas or opinions of others of no importance to him. A man having responsibility must of course make the final decision in matters for which he is responsible, but he who thinks that ultimate responsibility is inconsistent with the careful weighing of the opinions of other intelligent men makes a great and sometimes fatal mistake. Bacon spoke the truth when he said. "The greatest trust between man and man is the trust of giving counsel."

Heroic Self-Sacrifice vs. Simple Justice.

Park Benjamin, in a letter printed in the "Evening Post," of New York, calls to stern account those "demagogues who lately have been expatiating on the 'social gulf' between the quarter-deck and the forecastle," the occasion for his doing this being the heroic act of Lieutenant-Commander Jesse M. Roper, who, while in command of the "Petrel," sacrificed his life in an effort to save a sailor who was overcome by the smoke of a fire in the sail room of the vessel. Mr. Benjamin closes his letter as follows: "Meanwhile, the rest of us will believe that the hero, who thus with magnificent gallantry and devotion gave up his life for his men, knew best how near to his heart they were."

This is, we suppose, regarded by Mr. Benjamin, who was formerly a naval officer, as a complete answer to those who criticise Sampson for his utterly snobbish reason for opposing the advance of Gunner Morgan.

It is about as logical as most of the arguments that are advanced in favor of letting the line clique have everything its own way in the navy, but, nevertheless, it seems to have nothing to do with the case. Firemen and others often risk their own lives for those whom they do not know at all and never see until the moment of rescue. People risk their lives to save those of pet dogs, cats, canaries, and parrots. This they do entirely independently of whatever gulfs may or may not exist between them, and it is a familiar fact that a man may hold another very "near his heart" without being at all willing to accord him simple justice and equal human rights. Nobody denies nor wishes to detract from the nobility of Roper's act, but, like the flowers that bloom in the spring, it has nothing to do with the case in the way that Mr. Benjamin evidently thinks it has. By his system of logic, the civil rights of women that have been gained by the progress of enlightenment and the slow growth of the sense of justice would have been properly opposed because men generally have held their wives and daughters close to their hearts and have on occasion sacrificed life for them.

Calling those who differ with you in opinion "demagogues" is a very popular and a very cheap way of answering their arguments, especially when there is nothing to be said in the way of a real answer. Men who have raised their voices against

abuses or injustice have always been called demagogues since the practice of burning them at the stake, drawing and quartering them, etc., fell into disrepute, but that has not permanently blocked the wheels of progress, and the practice has been even known to react unpleasantly.

Foundry Etiquette.

A strike for a novel cause is said to have been made in a Connecticut foundry. It seems that the foreman of the foundry named Loudon insisted upon being addressed by the men as "Mister" Loudon, and the men—or at least some of them—preferred to call him just Loudon. He discharged one of them for doing this, and all the men stopped work. This seems to raise several interesting questions. Among them whether molders are employed to be polite to the foreman or to make castings; whether men who say "mister" really have any more respect for a foreman than those who say "Loudon" or "Smith"; whether a foreman can rightfully require the men to say "mister" while he himself says "Jack" "Jerry," "Jim," "Jones" or "Johnson." In the army and navy, men are required to observe forms in adddressing the bosses, but we don't believe it will work in foundries, and our impression is that the foundry foreman who can't impress his men with an appreciation of his dignity in any other way than by the issuing of a court circular had better let his dignity go and devote his attention exclusively to getting lots of good castings. A dignity which won't take care of itself is not of much account, anyway—especially in a foundry.

The Junior Mechanical Engineers on Superheated Steam.

The last meeting for the season of the local organization of the Junior Mechanical Engineers was held in this city on April 2. A paper on "Superheated Steam" was read by Mr. Ernest H. Foster, who was followed by a number of speakers, each contributing something of interest and value to the topic of the evening. Mr. Foster has been engaged in professional work in England for three or four years, and his paper, besides being a general argument for the use of superheated steam, dealt mostly with actual British and European practice. The use of superheated steam is many times greater on the other side than here, and there seems to be no dissent from the opinions as to its advantages. The general opinion of the speakers of the evening was that the use of superheated steam is certain to be much more extensive in the United States in the near future, and that in that direction is the promise of the greatest and most easily attainable economy. More than a generation ago superheated steam was tried to some extent, and discussed still more in this country by the leading engineers of the day, and so many practical objections were urged against its employment as to discourage many who otherwise doubtless would have tried it. Many of the objections urged have disappeared with the use of new materials of engineering and with the general changes in practice, so that now is a very favorable time for us generally to take up superheating. It does not call for minute refinements of arrangement and construction or higher skill to look after. It is as applicable to the common, everyday engine as to the most elaborate, and in fact is conceded to show the greatest savings on the poorest class of engines. The apparatus is not costly, and in new plants may cost nothing, as the jacketing of cylinders is done away with and the use of a multiplicity of cylinders also is discouraged. The cost of maintenance also cannot be excessive, as Mr. Foster told of installations in constant service for from six to ten years without repair or renewal. The material of the superheater is usually steel, wrought iron or cast iron, the latter being most commonly employed in Great Britain, and being decidedly the best. Temperatures maintained range from 400 to 600 degrees Fahr. If long pipes are unavoidable, it is better to have a superheater at the farther end, and as near as possible to the engine. Engines with poppet valves are better adapted to the use of superheated steam than those with any type of sliding valve. While we have so little trouble about lubricating gas engines, in which the temperatures range much higher, the old and chief objection to superheated steam in the impossibility of lubrication evidently no longer applies. Mineral oils are good for higher temperatures than any which it is proposed to employ with superheated steam. Better vacuum is maintained with its use, and where water is an item to be considered, less will be required than without the superheater.

The most discouraging feature of the series of Junior meetings just closed has been in the attendance. The meetings would have been enjoyed and appreciated by many more members if they had been present, and the topics considered would have developed more of value if a greater number had participated in the discussions. It is to be hoped that better results may be reached next year. In the meantime those who have labored thus far to promote and sustain the meetings are entitled to the thanks of the society and of the profession in general.

Legal Notes.

WM. MARSTON SEABURY, LL.B.

ASSUMING THE RISK OF PASSING UNDER A PUNCH LEVER.

Abram Goodman was employed by Moses Crystat and another, as a cabinet maker on folding beds. On one occasion he was directed to go up from the second floor, where he usually worked, to the third floor and fix some springs on folding beds there. On the third floor was a punch operated by an iron lever 2 inches in diameter, 6 feet long and weighing 18¾ pounds. The punch was elevated 3 feet and the lever was attached 4 feet above the floor, and, in operating it, had to be raised 6 feet above the point where it was attached. It extended out 5 feet and 3 inches, and, when down, reached across the open space between the punch and a partition which projected into the room and blocked the passageway from the point where Goodman entered to the place where he was to do his work, so that a person passing would have to climb over the lever when down, or go under it when up.

The punch was being operated by a boy of 18 years of age and by a much younger one. As Goodman approached, he saw the younger boy in the act of operating it and told him to stop. The boy did not stop and Goodman attempted to pass and was injured by being struck on the head. He sued his employers for damages in the New York Supreme Court, where he received a judgment in his favor. Upon appeal, the Appellate Division of the Supreme Court reversed it on the ground that the plaintiff was himself guilty of negligence and that "in passing under the iron bar at the time he did, under the conditions which he plainly saw, the danger of which was clearly apparent, as is shown by the fact of his telling the boy to stop, he must be held to have assumed the risk." 101 St. R., 260.

Examination for Inspector of Mechanical and Electrical Engineering.

The United States Civil Service Commission, Washington, D. C., announces that on May 7 and 8, 1901, an examination will be held in any city in the United States where postal free delivery has been established, for the position of inspector of mechanical and electrical engineering, in the Supervising Architect's office, Washington, at $2,190 per annum, and other similar vacancies as they occur. The examination will consist of arithmetic and elementary mathematics, practical questions in mechanical and electrical engineering, drawing and design, technical education and experience. Age limit, 20 years or over. Persons wishing to compete should at once apply for application forms 304 and 375.

The sixth annual convention of the National Association of Manufacturers will be held in Detroit, Mich., June 4, 5 and 6. George H. Barbour, of Detroit, the Michigan vice-president of the association, is in general charge of the arrangements there. The opening of the Pan-American Exposition at Buffalo a few weeks prior

to the convention will enable manufacturers to arrange for a trip to take in both points. It is expected that arrangements will also be made for excursions to points of interest on the Lakes after the adjournment of the convention.

A Davenport (Iowa) paper publishes an item, which, though it is not so stated seems to relate to some sort of a rotary engine, the claim being made that the dead center and various other objectionable things connected with an ordinary engine are done away with by this new invention and that in consequence of this there is a gain in power of 27 4-11 per cent. Kindly note the fraction 4-11 per cent. If the saving were claimed at a round 30 per cent., or even 25 per cent., there might be some doubt about it and we might think that the figures were subject to a slight discount perhaps, but when we are informed that the saving is exactly and precisely no more and no less than 27 4-11 per cent. there can be no possible doubt about it, and of course the thing for people to do who have money that they have no use for is to step up and invest it in this invention.

Commercial Review.

NEW YORK, Monday, April 8.

MACHINERY AND SUPPLIES.

Such business interrogations as have been put forward in the past week in the local market have chiefly been to representative supply houses. The replies received indicate for the past month an expansion from February trade, and in several of the cases a business as heavy as at the corresponding time last year, although certain others note a falling off of 20 or 25 per cent. The latter, however, are by no means dull, and one house whose principal line is twist drills did a better trade in March this year than in any other month of its history.

Uncertainty as to prices is not now present as a disturbing factor in the supply market. These are generally steady; there is too good a demand and too many bullish rumors in connection with the steel market to favor a decline, while manufacturers have had sufficient experiences with the discouraging influence of sharp advances to be disposed to mark them up rashly.

Power-transmitting machinery is in excellent selling, and one house reports trade 100 per cent. better for the first quarter of the year than for the corresponding portion of last.

At the office of one of the largest machine-tool establishments in the country is reported the closing of a fine run of orders, which show a distinct improvement in demand, especially in the line of heavy tools.

NOTES ON FOREIGN INDUSTRY.

A small tool and supply house which has a good deal to do with the foreign market reports that while European export trade is poor, generally speaking, the orders closed for shipment abroad in the last two weeks have exceeded those of the previous six months. An exception to the generally unfavorable condition is found also in steam pumps, for which a demand is noted in England, France, Germany, Russia, Austria and Italy. This is accounted for on the ground of the superior economy claimed for this line of pumps referred to taken in connection with the fact that high prices of coal render small steam consumption a more vital consideration in Europe than in America.

Export returns for February, 1901, show shipments of metal-working machinery amounting to only $217,956, as compared with $585,854 for February, 1900, a falling off not far short of two-thirds. Since July 1 last, the exports have been $3,007,480, against $4,685,984 for the corresponding period a year earlier, showing a decrease of one-third. On the other hand, electrical machinery exports are fast climbing to the magnitude of metal-working machinery at its best. For February, 1901, they attained $566,494, which is nearly double the valuation for February, 1900.

It is said that the Russian Government, in order to foster the iron industry in the empire, has issued an edict that foreign offers will be refused if those made by domestic firms are not more than 15 per cent. higher.

Mr. N. Selikoff, the chief of the commercial department of the Trans-Siberian Railway, whose headquarters are at Tomsk, is desirous of receiving price lists, catalogs and samples of American articles likely to be of interest to that part of the world.

While Austria-Hungary, like some of her neighbors, feels the effect of American competition in trade, she is disposed toward a conciliatory policy in meeting it. An important gathering of Austrian manufacturers just held in Vienna dealt largely with this question. A resolution was adopted unanimously declaring the necessity of placing the commercial relations of the dual monarchy with the United States on a basis of reciprocity and equality simultaneously with the renewal of the commercial treaties in 1903.

Engineering enterprises in British India, reference to which has lately been made, are further exemplified. "Following a recent bad example," says "Indian Engineering," "Major C. C. Townsend, R. A., is deputed to England and America for eight months in connection with the electric machinery for the new Central Gun Carriage Factory, Jubbulpore. But we can hardly credit this piece of information. The Ordnance Department is not likely to give as free a hand to one of its officers as the item of news would lead one to suppose. Mysore purports to afford an object lesson to all India in such matters." At the Cossipore Gun and Shell Factory, steel is melted by the Siemens-Martin process. The factory is now being used only for manufacturing shells, fuses and tubes, and the component parts and fittings of breech-loading guns, the manufacture of the guns there having been given up about 1872 when the last R. M. L. gun was sent out from the works.

Electricity is to be the motive power in the new Khargpur workshops, B.-N. R. E. Stanley Franklin has been appointed electrical engineer for the shops. We are unable to state what stage the work has reached.

There is an excellent field for the introduction of automobiles in Shanghai, where the streets are of the right sort and such vehicles would be cheaper to use than horses and carriages. The establishment there of an electric trolley omnibus line is advocated, as it would save the trouble of laying tramway rails.

American manufacturers of mining machinery should keep an eye open toward the West African gold fields. The prospects for a development of this region are attracting attention in England, and the hope is expressed there that the work of equipment may be carried out by the nation which has subscribed the capital for that purpose, viz., England. A constant stream of mining engineers is now going out thence to the West Coast, every ship taking its group and as yet only a bare equipment has been provided, so that the field from an engineering point of view is practically unbroken ground. The mines of practically all the companies are worked from London.

Acting Consul-General Westacott, of London, reports that he has received a number of inquiries for the names and addresses of firms in the United States manufacturing machines for printing paper hangings. Replies should be sent to the consulate-general.

According to a French authority, there is an urgent demand in Guadeloupe for engines, boilers, evaporative apparatus, etc., for the complete installation of a cane-sugar factory producing 500,000 kilogrammes of centrifugal sugar per season; also for small cane crushers to be operated by animal power; machinery and apparatus for small sugar mills; machinery and apparatus for a sole leather tannery with an annual capacity of 5,000 hides; tan mills and other machinery. It is suggested that detailed information as to size, weight, capacity of production and price of the apparatus be addressed to M. T. Papin Beaufond, Bateaux à Vapeur, Pointe-à-Pitre, Guadeloupe. As there is doubt how much consideration American manufacturers would receive in that quarter, it seems a case in which use might be made of "The American Exchange" recently established at Pointe-à-Pitre, as mentioned on page 190 of the present year.

While we cannot speak certainly of the standing of this exchange, it appears to fit in well with the present emergency.

CUBAN TRADE.

A correspondent inquired a few days ago as to the state of the Cuban trade. The Cuban market, which used to be a Klondike in the old days before the war, became an object of absurdly high-flown hopes upon the re-establishment of peace, and because these hopes proved to be utterly illusive, for the time being at least, it may be that one is inclined to give the island less consideration than it really deserves.

This tendency will hardly be counteracted by a statement just issued by the War Department, showing the amount of Cuban commerce for the first three-quarters of 1900 as compared with the same period of the preceding year. The total value of merchandise imported in that period of 1900 is $49,701,098 and for the same part of 1899, $46,838,122, showing an increase of only 6 per cent. Including gold and silver, the imports were $53,108,702 for the period named of 1900, against $54,636,746 for that part of 1899, showing a falling off. The exports of merchandise for the first three-quarters of 1900 were $38,020,038, against $38,672,146 a year earlier, showing a slight decline. The total value of all exports for that portion of the year was $40,196,702 in 1900 and $42,282,530 in 1899, showing a greater decline. In the period named of 1900, $24,525,059 worth of the total imports came from the United States, while in that part of 1899, $28,094,030 had come from this country. There was consequently an absolute decrease of over 12 per cent. in the imports from here, as well as a slight diminution of the proportion of the total that came from this country. Meanwhile the imports from Europe increased from $19,481,660 to $21,559,239, and the trade that has fallen off with the United States has gone largely to Great Britain and Germany.

To the above it may be added that exports from the United States to Cuba as shown by our Bureau of Statistics, Treasury Department, for the eight months up to the end of February, 1901, amounted to $17,236,752, as compared with $17,172,472 for the same period ending February, 1900; $10,142,949 for that ending February, 1899; $7,689,323 for that ending February, 1898; $5,494,777 for that ending February, 1897, and $5,423,189 for that ending February, 1896.

The inferences from figures such as those above are to be deplored by any friend of Cuba. Can it be true that in the year 1900 there was hardly any improvement over her trade for 1899, the year immediately following the devastation of war? The figures showing the imports from the United States are inconclusive, for they may have been made up largely of military supplies, but that her exports to this country in 1900 were about 12 per cent. less than 1899 sounds preposterous. Until she has better success in raising and marketing her own products it is blind egotism for us to suppose that we are going to make her buy any great quantity of our machinery.

Trade with Cuba is not entirely dead, however, as is shown by reports like the following:

"The Birmingham (Ala.) Machine and Foundry Company has received an order from Cuba for seven Corliss engines, which, it is stated, will cost when completed nearly $100,000. The engines are to be used on sugar plantations. The Krawjewski-Pesant Company, of New York city, has received a contract for a 26x78-inch sugar-cane crusher and a 22x36-inch slide-valve engine, which have been requisitioned for the Central, San Jose, Cuba. This machinery is to be built at the Erie Basin Iron Works, of Brooklyn. The Krawjewski-Pesant people have but just secured a number of miscellaneous orders for plantation supplies."

A local supply and machinery house which has lately sent a salesman to Cuba is receiving fair orders from him, but nothing great. As a man who has been talking with business men closely in touch with Cuban trade remarked to the writer, the political uncertainties of the country prevent the investment of capital there.

CHICAGO MACHINERY MARKET.

A party of about sixteen electrical machinery men visited the works of the E. P. Allis Company, at Milwaukee, a few days ago, to see the first of the 5,000-kilowatt direct-connected engines constructed for the Manhattan road of New York. The engine was then on the floor, but has since been shipped. The party represented six or seven prospective buyers, who within the next sixty or ninety days are expected to order engines to the value of about $2,000,000. Their wants will include about fifteen engines of similar size to the one inspected, besides a number of smaller ones. All this prospective business is from street-railway and lighting plants. This incident represents the general condition of trade in engines and boilers. Representatives of builders are extremely busy, responding to inquiries and some of them are obliged to ignore or postpone action on quite a number of the orders in sight.

The tendency to run to the larger units of power is very decided. This is true, not only with the large Corliss engine builders, but with the medium and small engine works also. Shops, which two years ago were building engines of from 10 to 300 horse-power and were then busy in all departments now find demand for the larger sizes to be in excess of their capacities, while the shop space and equipment devoted to the building of smaller engines are not fully engaged. This condition is leading in some instances to the reconstruction of engine and boiler plants.

Another noticeable change in the engine trade is an increasing percentage of orders for direct-connected engines, a greater percentage of manufacturing plants now calling for that description of power.

A recent rapid development has occurred in the demand for hot-water heating plants. A contract for perhaps the largest undertaking of this kind has just been closed for the Home Heating and Lighting Company, of Indianapolis, Ind., which has bought boilers of about 750 horse-power from Wickes Bros., and also purchased large engines and generators. The company will lay 8 miles of street mains and by means of pipes heat the houses in an extensive residence district. In many cities and towns in the West during the past winter similar installations have been made, exhaust steam from the engines for lighting plants being used when possible, and, when unobtainable, a separate plant providing the heat.

For its new shop on Robey street, this city, the L. Wolff Manufacturing Company has purchased from the E. P. Allis Company a 300 horse-power direct-connected cross-compound engine. For the new Nye & Jenks Grain Company elevator at South Chicago a 1,200 horse-power Corliss engine has been purchased from the Atlas Engine Works.

Quotations.

NEW YORK, Monday, April 8.

Pennsylvania Foundry Pig Irons, Jersey City Delivery, good brands:

No. 1 X	$16 25 @ $16 50
No. 2 X	15 50 @ 16 00
No. 2 plain	14 75 @ 15 25
Gray forge	14 50 @ 14 75

Alabama Pig, New York Delivery:

No. 1 foundry, or soft	16 00
No. 2 foundry, or soft	15 50
No. 3 foundry	15 00
Foundry forge, or No. 4	14 75

Bar Iron—Base sizes—A meeting of mill men has just been held and higher prices may be asked, but, as far as could be learned previous to going to press, the prices last quoted are in force.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. upward.

Machinery Steel—Base sizes—From store, 1.90 @ 2.00c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper—Lake Superior ingot, 17c.; electrolytic and casting, 16⅝c.

Pig Tin—26 @ 26½c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½c. extra for carloads.

Spelter—3.95 @ 4.00c., New York.

Antimony is 10⅜ @ 10⅝c. for Cookson's, being about 10½c. for 5 or 10-cask quantities. Hallett's is 8⅞ @ 9c.; U. S., 9 @ 9¼c.; other brands, generally 8⅝ @ 8¾c.

Lard Oil—Prime City in jobbing lots, 72c.; 73c. for single barrels.

Converting an Old Planer Into an Indexing Gang Driller.

BY W. G. LUPER.

Thinking that perhaps a description of the machine used for drilling and tapping condenser heads in a Western navy yard would interest some of the readers of the "American Machinist," I submit the following:

There were needed for the "U. S. S. Boston" twelve condenser heads, 40x43 inches, with 1,512 holes each for main condensers, and two heads, 28x34½ inches, with 766 holes each for auxiliary condenser, a total of 19,676 holes to be drilled and tapped ⅞ inch, 14 threads, 11-16 inch deep, with 41-64 inch holes extending through heads for ⅝-inch tubes; heads 1 inch thick. The job would have blocked all of the drilling machines we have for many days.

Having an obsolete 34 by 42-inch by 8-foot planer that was doing little except occupying shop room, it was remodelled into a gang drill, with what success I will leave to the reader to judge.

The tool block, feed and belt-shipping mechanisms were taken off. An old pair of miter gears with bracket (a relic of the ill-fated "Charleston") was attached to the top of the vertical slide, as shown at *a*, Fig. 1. Two blocks carrying three drill spindles *b b b* were secured in place of the tool blocks. A horizontal driving shaft *c* supported at outer end by bracket from end of cross-rail, with large pulley for tapping and small one for drilling and tap reverse, served to drive the spindles.

It will be seen by reference to Fig. 2 that all drill spindles rotate in the same direction. A rack let into the back of tool slide, with pinion on feed shaft *d*, a large cast-iron hub *e* with eight 1-inch holes drilled radially, and a 40-inch piece of 1⅛-inch cold-rolled steel *f*, turned to 1 inch on end for a lever, completed the feed mechanism. The holes to be drilled were in equilateral triangles of 15-16 inch sides, 15-32 inch. It will be seen by referring to Fig. 3 that with holes *A A A* drilled, two turns of handle locate the drills for drilling *B B B*, ten turns for *C C C*, two for *D D D*, and so on. Upon completion of a row, one turn, or 15-32 inch, with platen moved to the next line on lateral index, locates the drills for beginning the next row.

A spring handle and latch were found in the scrap pile, where feed rack came from, on an old gear cutter. By making a notch for latch about 1¼ inches wide, the latch being ⅜ inch, the back lash in cross-slide screw was overcome, one side of the notch stopping latch in one direction, while the other side stopped it in reverse way.

The planer countershaft was used in its old location after putting on wider-faced driven pulley with larger and wider drive for machine, which, with lower pulleys on machine, were found in a pile of "spares." After some reboring, bushing and narrowing of faces they filled the bill very well. The drive on main shaft had to be lagged to increase diameter and face.

Left-hand drills were used in order to utilize same speed and motion for backing out taps. The drilling speed and tap reverse are about 250, with 70 for tapping. Both have tight and loose pulleys on shaft supported by cross-rail, and each has a

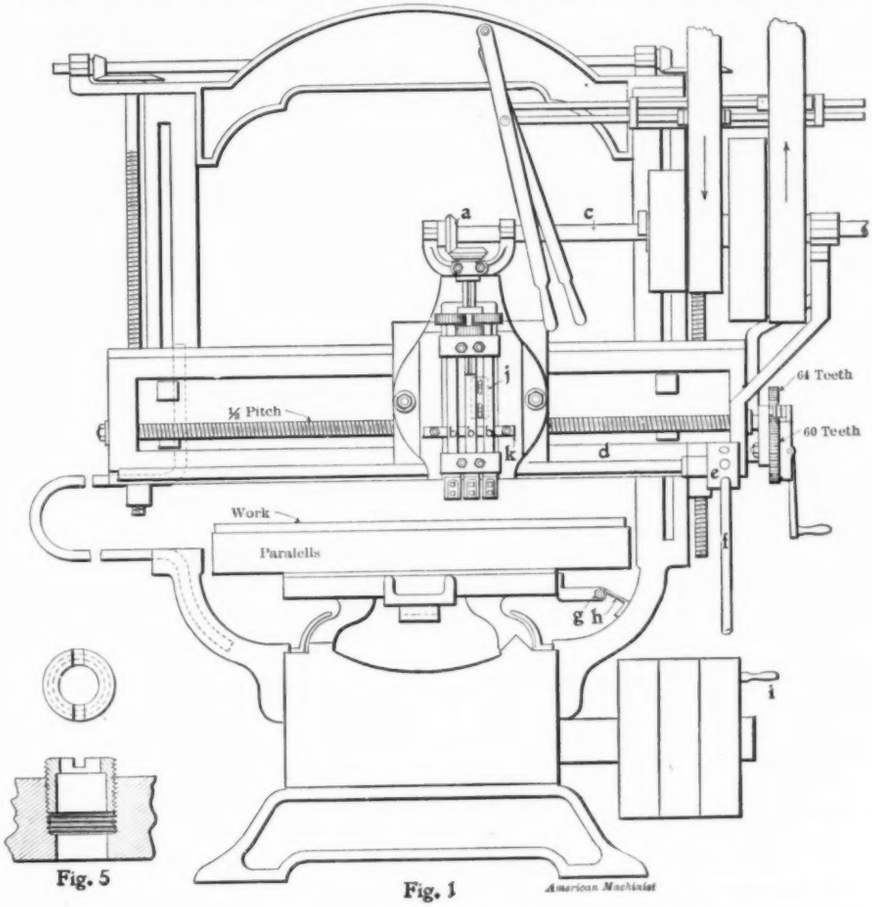


Fig. 1

Fig. 5

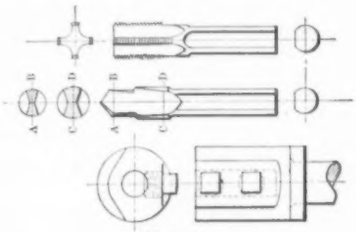


Fig. 4

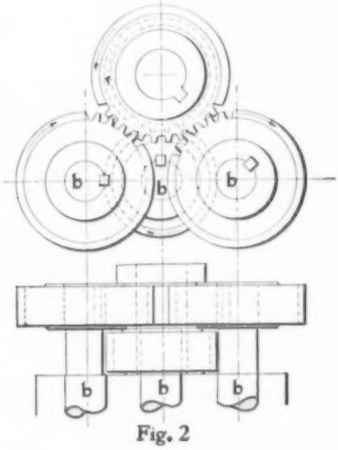


Fig. 2

Fig. 3

AN OLD PLANER CONVERTED INTO AN INDEX GANG DRILLER.

belt-shipper extending down within easy reach of the operator.

Fig. 4 shows drill, tap and lower end of spindle with method of chucking. A piece of ½x1½x5-inch iron *j*, with two slotted holes, held by two studs to tool slide, forms a depth gage for the drills by striking a stationary crossbar *k*.

The tension of tap drive belt is just sufficient to drive taps to bottom of counterbore, Fig. 5, which acts as a stop, the cross-rail being easily raised or lowered to give the correct tension. When the taps reach the bottom of counterbores the belt slips and can then be shipped to loose pulley and throw the reverse belt on to back the taps out.

Not more than four hours were consumed in tapping any plate of 1,512 holes, and one was tapped in 2 hours 36 minutes, or 9.7 holes per minute. The drilling time varied a great deal, some of the plates being very hard. One row of thirty-six holes was drilled in 3½ minutes, and one head of 1,512 holes was drilled and tapped in 7 hours 3 minutes. The average for drilling and tapping combined was twelve hours per head. The operator was a young man with no previous machine experience, but with plenty of ambition. The machine is now being used to drill 2-inch holes, 2 31-32 inch centers, in evaporator heads, using one drill only. It is obvious from the above that there was no laying out, except to locate a starting point.

For the largest heads, which are circular, it is suggested to cut out housing, as shown in Fig. 1, and connect with U-shaped forgings. Fifty-four-inch heads can be drilled without turning; larger ones will have to be turned halfway around to finish.

The Manufacture of Rapid Fire Guns—II.

BY E. G. PARKHURST.

Following the operations described in the previous article come the following: End-milling the bottom of T-slot for the extractor; squaring up the bottom of this slot by hand; hand-finishing the housing to breech block gages, and shrinking the jacket and tube together, or performing the marriage ceremony.

SHRINKING.

Fig. 11 shows the interior of the shrinking room. At the right is the furnace in which a jacket is secured in upright position, and above it is the air hoist with hook for raising the tube and its appliances, also for hoisting the gun after shrinking. At the left are shown several guns that have been shrunk and a couple of unshrunk tubes. In the foreground is shown a fixture for shrinking one-pounders. The shrinking pit consists of masonwork underground, above which is a strong cast-iron plate for supporting the fixture, on which the jacket of gun is secured in an upright and central position.

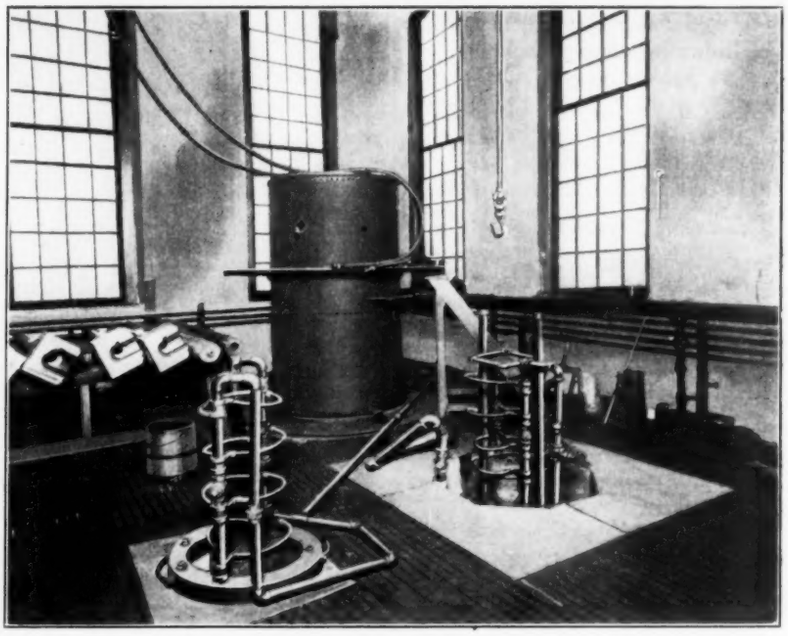


FIG. 11. INTERIOR OF SHRINKING ROOM.

Extending the whole distance around the base of fixture, is an apparatus having an inlet for gas and compressed air at 80 pounds pressure per square inch. From the gas aperture, extending upward, are four gas pipes having four pipes connected to them which extend around the jacket. The upright pipes are divided, so that the upper portion can be closed by cocks in order that the upper end of the jacket, which is thin, may not be overheated. There is an upright water pipe passing at its upper end entirely around the upper portion of jacket. It is pierced with holes from which jets of water may chill at the first, and make the thin portion nip the tube at the curved joint, in order to keep it from crawling when the jacket contracts. From the base of the fixture extend upward two stout rods, having at their upper ends flanged heads, under which may be swung and stopped a cross-head having slots cut at each end. The cross-head at its center has a hollow screw with aperture large enough to slip over the tube and rest on its enlarged part, the collar which forms the curved joint on the jacket. This hollow screw acts like unto a capstan having bars. In operation, the cross-head with hollow screw is placed on the tube, and before placing waterway (to be described later) in position. It thus hangs on the tube and drops with it. After dropping the cross-head is swung around under the flanged heads on the uprights as quickly as possible. The hollow screw is now screwed down by the capstan levers, the jets of water are turned on, and a good joint at the mouth of the jacket is insured.

WATERWAY APPARATUS.

This apparatus, shown in Fig. 12, for passing a stream of cold water through a gun tube, even while the jacket is being heated, was arranged in 1888 and put in practice on the first gun shrunk together at the Pratt & Whitney works. It consists of six parts. The body *B*, with which is connected the inlet and outlet hose, secured in the usual manner; the pipe *C*, smaller than bore of gun tube. *A* is screwed fast in *B* and extends nearly to

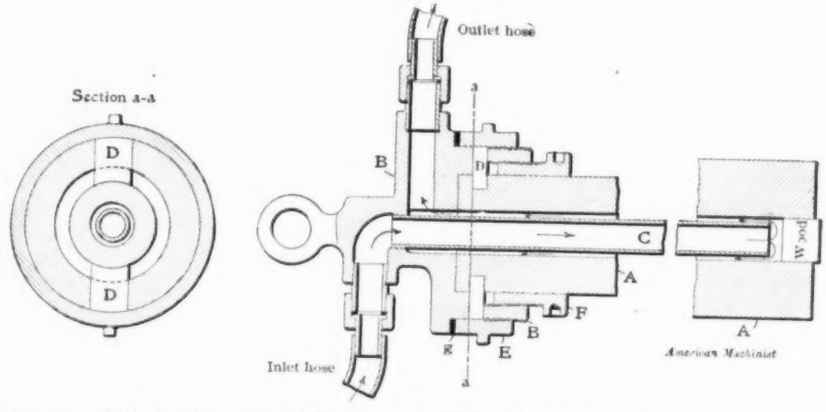


FIG. 12. APPARATUS WITH WATERWAY FOR KEEPING THE TUBE COOL WHEN BEING SHRUNK INTO A JACKET.

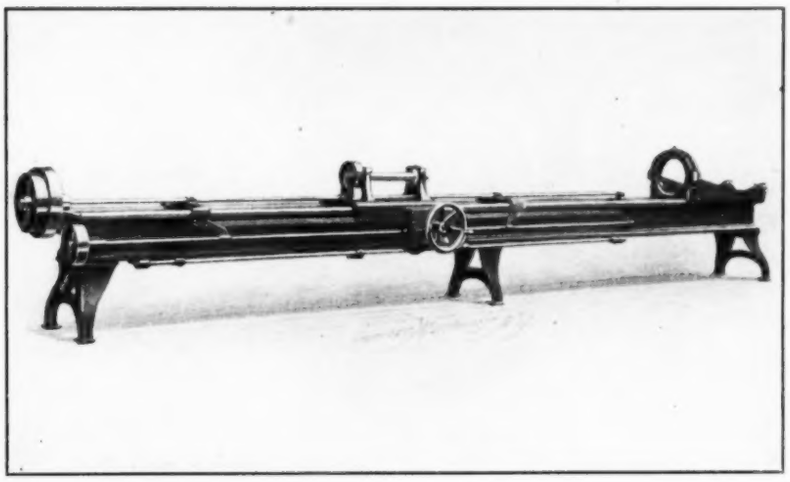


FIG. 13. LAPPING MACHINE.

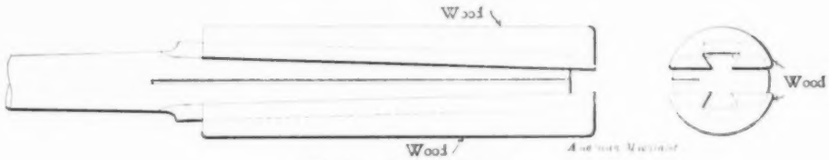


FIG. 14. LAPPING HEAD.

the bottom of the tube, which is plugged with a wood plug at the breech end. Thus a stream of water is forced from inlet hose down *C*, out at the lower end, into, and up the tube through outlet hose. The slides *D D* pass into annular groove in the tube and are closed and made watertight by the closing nut *E* being screwed over them and against rubber gasket *g*. The packing nut *F* fits the taper of the tube, and when screwed home packs the joint.

In operation the nut *E* is screwed well up to *B*, and *E* is screwed well down, so as to expose the slides *D D*. The gun tube is then inserted until it bottoms on *B*, when the slides are pushed in and nuts *E* and *F* are tightened. The tube may now be suspended over the jacket by the hoisting hook and the eye on the upper portion of *B*.

The jacket being placed in the heating apparatus and the tube having had the waterway apparatus inserted, it is suspended exactly over the mouth of the jacket. The gas is first lighted on the lower section of the upright gas pipes to heat the thick portion of the jacket first, after which the upper gas jets are turned on. The maximum temperature should not exceed 500 degrees Fahr., a suitable high-grade thermometer being used to determine the temperature and a star gage with wood star being used to test the expansion. The air-hoisting mechanism is so arranged that a continuous drop can be had. The shrinking allowance is usually about .005 inch. All tubes are star-gaged for measurements before being shrunk in, in order to ascertain how much the shrinking compresses the bore.

A few years ago, when the art of manufacturing built-up guns was in its infancy, many persons were anxious to know all the whys and wherefores relating to the art, particularly the representatives of the press, who were daily in quest of news items. The manager of the plant, wishing to gratify all reasonable demands, and thinking the shrinking process would be an interesting matter, invited some half-dozen reporters and their friends to be present at a certain date and witness the marriage of a tube and jacket for a four-inch gun. All were on hand at the appointed hour, the jacket being nearly heated. They stood around with opened notebooks and jotted down all items obtainable such as related to heating and measuring the jacket, the amount of gas consumed, the air pressure, etc. They saw the final measurements of jacket, which was pronounced correct. The gas was shut off and the signal given to drop the tube. It went into the jacket with a rush, but was nipped 16 inches short of being home. To outsiders it was a beautiful spectacle to witness. No words were spoken by the operators, who took in the situation at a glance, and as soon as could be done consistent with politeness, the spectators were invited to witness other portions of the plant remote from the shrinking room. The evening and morning papers gave glowing accounts of the successful marriage. Later on, the operators had a very serious time in performing the divorce ceremony, which was attended with much vexation. No double adjectives could be found to suit such a situation. The matter never leaked out, and I believe this is the first time the story has been told to outsiders.

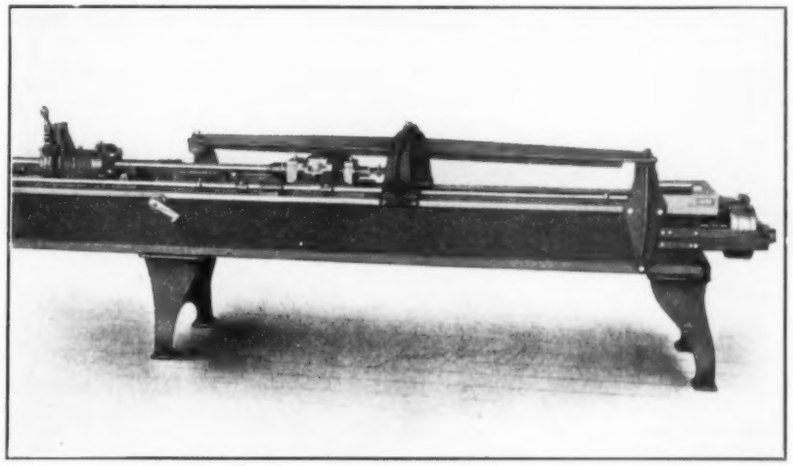


FIG. 15. RIFLING MACHINE.

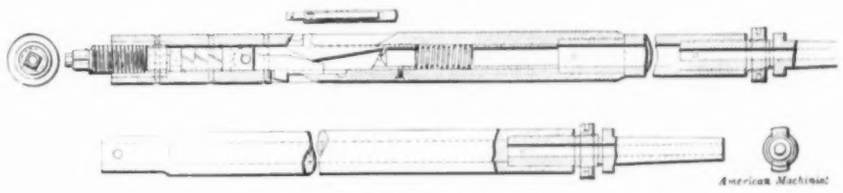


FIG. 16. RIFLING HEAD.

After the shrinking the jacket is turned for the locking ring; the screw-thread is cut on the same, and by a surface plate the jacket is scribed for the sight mass. The bore is then again star-gaged to ascertain the effect of the shrinkage, and the bore is lapped to the required size.

LAPPING THE BORE.

The lapping machine is shown in Fig. 13. It has mounted at one end of its bed a fixture for centering and securing the tube to be lapped. Also

FIG. 17. BREECH BLOCK AND FIRING MECHANISM OF 6-POUNDER AMERICAN MODEL HOTCHKISS GUN.

at the top of the bed are attached the journal boxes and sliding supports for the long splined shaft, which is belt-driven from a two-grade cone pulley. A carriage travels on the bed, controlled by rack and pinion action and operated by hand, or fed automatically by gear and worm action from feed belt. The feed can be operated in either direction, and reversed in any part of traverse of the carriage by adjustable stops. On the carriage is fixed the head, in which is mounted, and gear-driven, the rotary spindle, to which is attached the lapping rod and lap.

The lapping head is shown in Fig. 14. The round shank is long enough to reach the entire length of the tube and connect with the running spindle of the machine. It terminates at its working end in a flatted wedge having longitudinal dovetailed ribs, on which are fitted wood pieces which are turned to a lesser diameter than the bore. A sheet of emery cloth, one end of which is made fast, is wrapped around the wood, which may be expanded by a blow of a wood mallet at such times as the lap end projects out of the tube. The lapping is watched with a star gage and is finally plug-gaged.

The plug gage is cylindrical and of the normal size of bore. It should be eight diameters in length and have a wood handle long enough to pass the entire length of tube. Plug-gaging is a dangerous operation if there be any heat in the tube above the normal temperature of the room where the operation is performed, because there is a liability of the gage being nipped, and if it is, goodby to both tube and gage. Such a thing has happened, and more than *twice*.

Following the lapping the locking ring is put on, a hole is drilled, counterbored and tapped for the blind head-screw which holds the ring from turning back from the shoulder on the jacket, and the screw is put in place. After this comes

RIFLING THE BARREL.

The rifling machine, shown in Fig. 15, is constructed on the same general principles as the one used for small bores (illustrated and described in the "American Machinist" No. 17, of last year), except that it does not automatically index the tube. It has, however, the addition of a picker for removing the chip from the front of cutter, where it usually coils itself, and if not surely removed, would be drawn back into the bore. Each groove

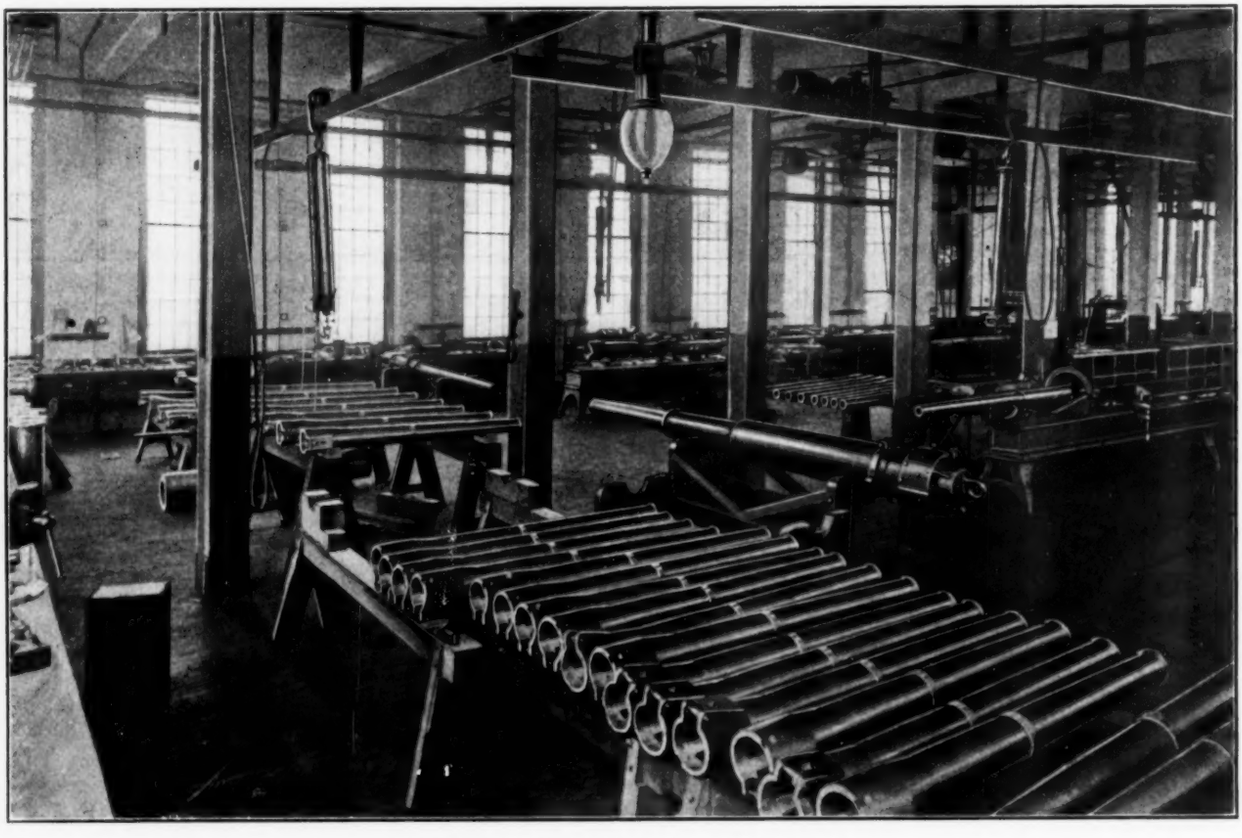


FIG. 18. INTERIOR OF ASSEMBLING DEPARTMENT.

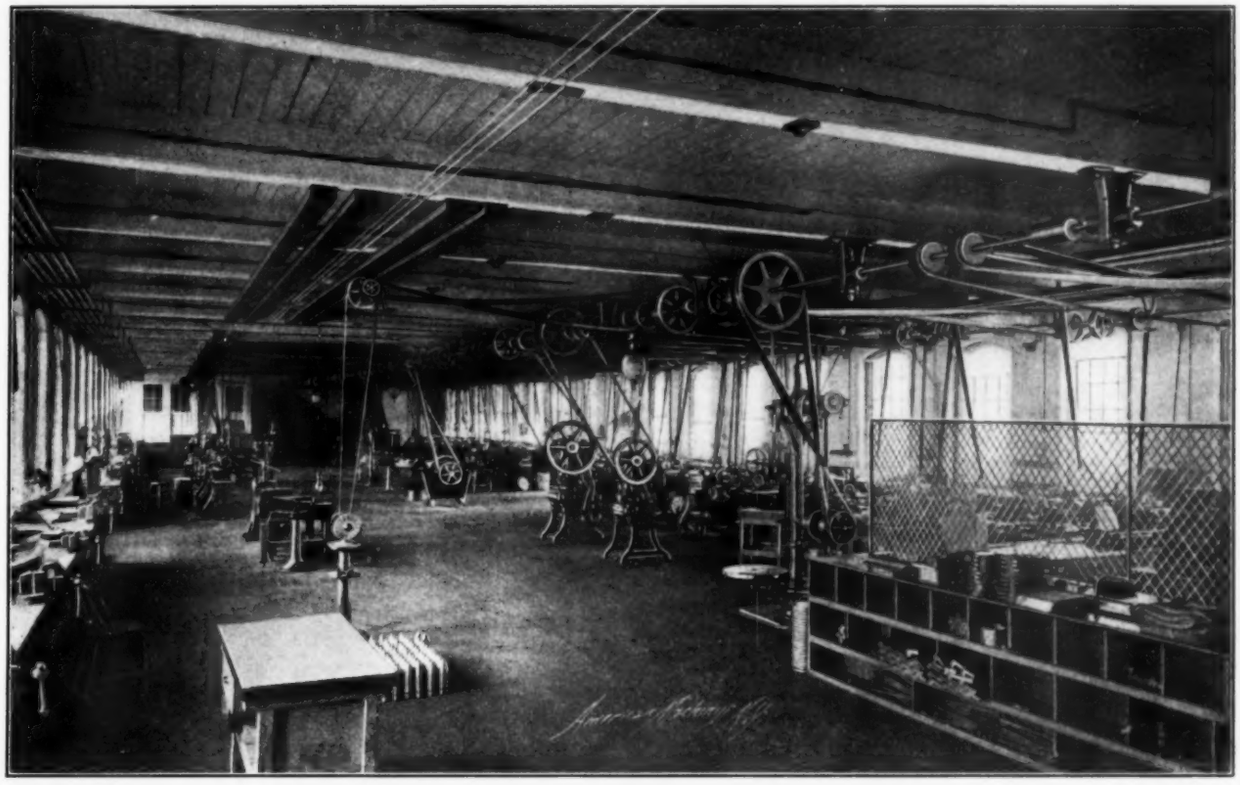


FIG. 19. INTERIOR OF PROJECTILE DEPARTMENT.

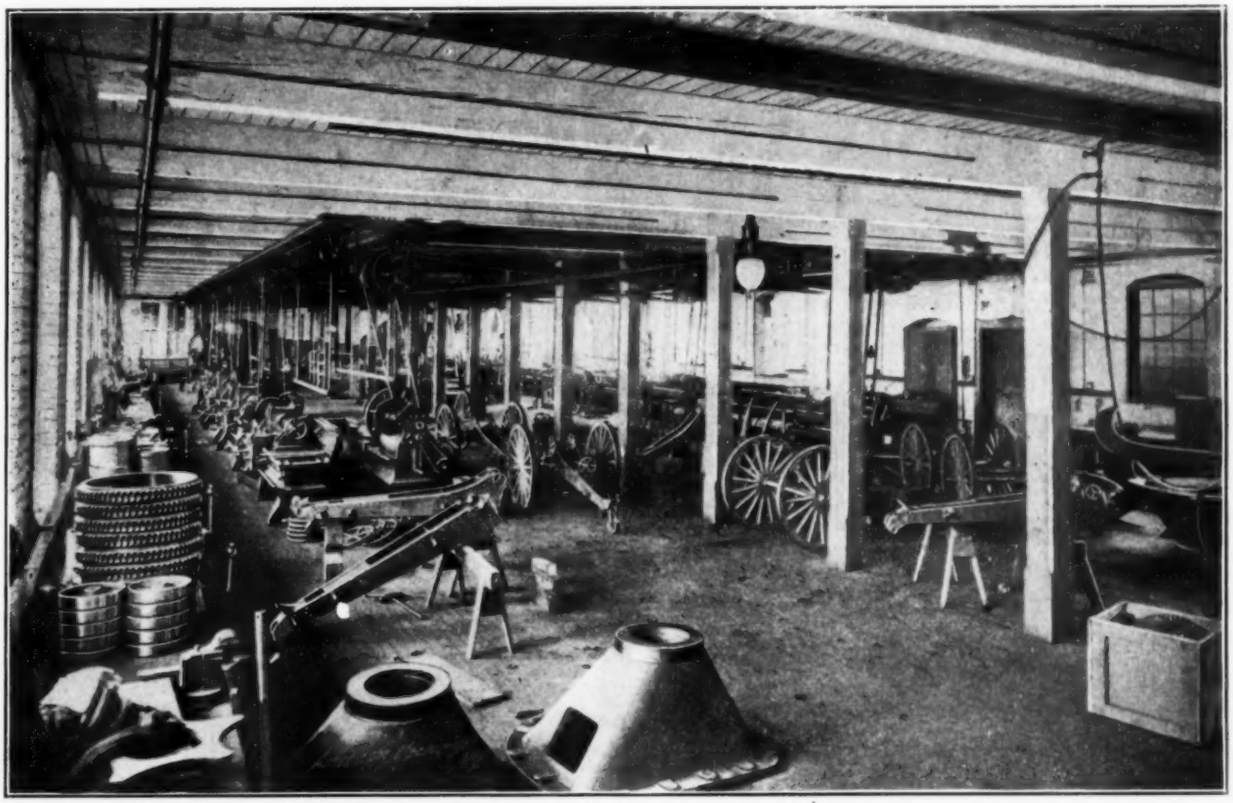


FIG. 20. INTERIOR OF MOUNT DEPARTMENT.

is finished before another is begun, because no steel has been found which will keep its cutting edge long enough to finish a series of grooves. The hollow spindle of machine through which the muzzle of the gun is placed has on its outer end a grooved face-plate or flange carrying four equally spaced dogs. Two of the dogs engage the annular groove in the muzzle end of the tube (shown in Fig. 12), and the others engage two notches already referred to. The exact location of the gun in the machine is thus secured, and it may be removed and replaced at will, with certainty that it will come to the right posi-

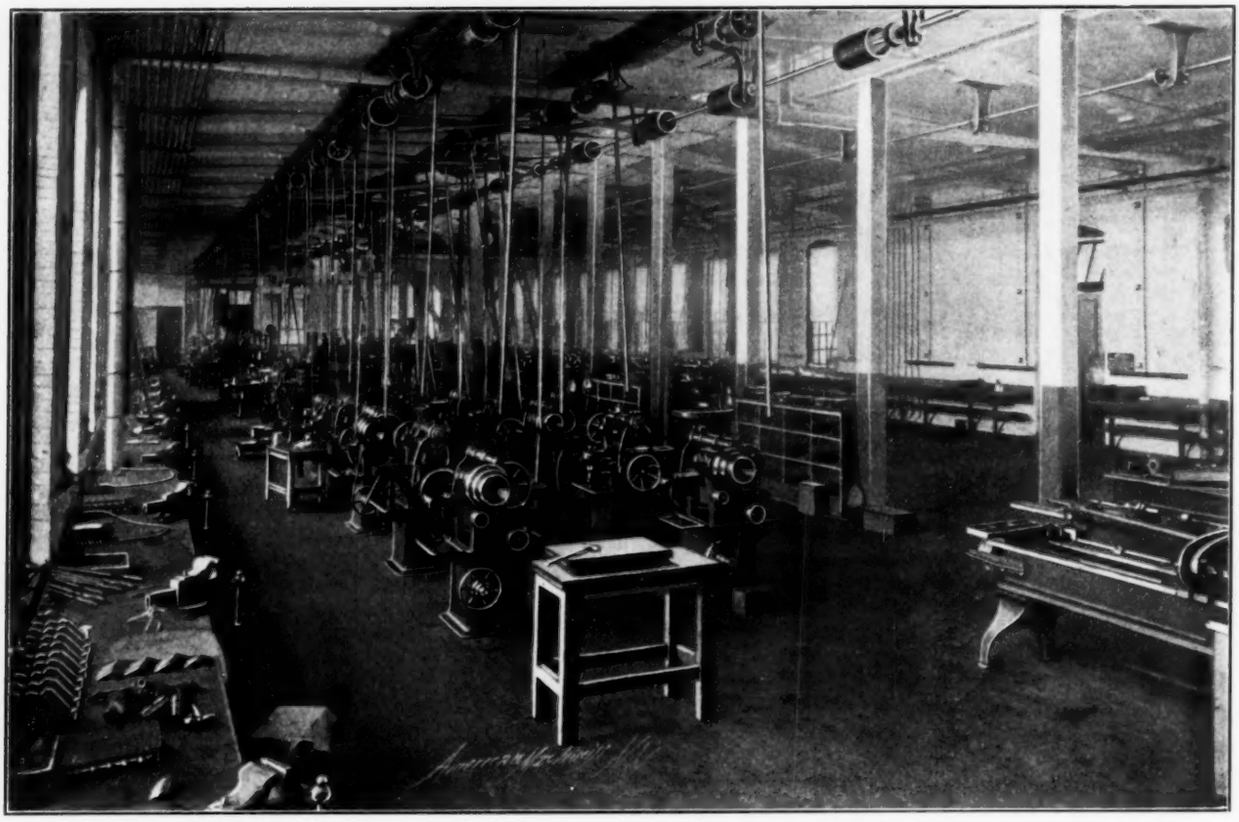


FIG. 21. INTERIOR OF LIMB WORK AND BREECH BLOCK DEPARTMENT.

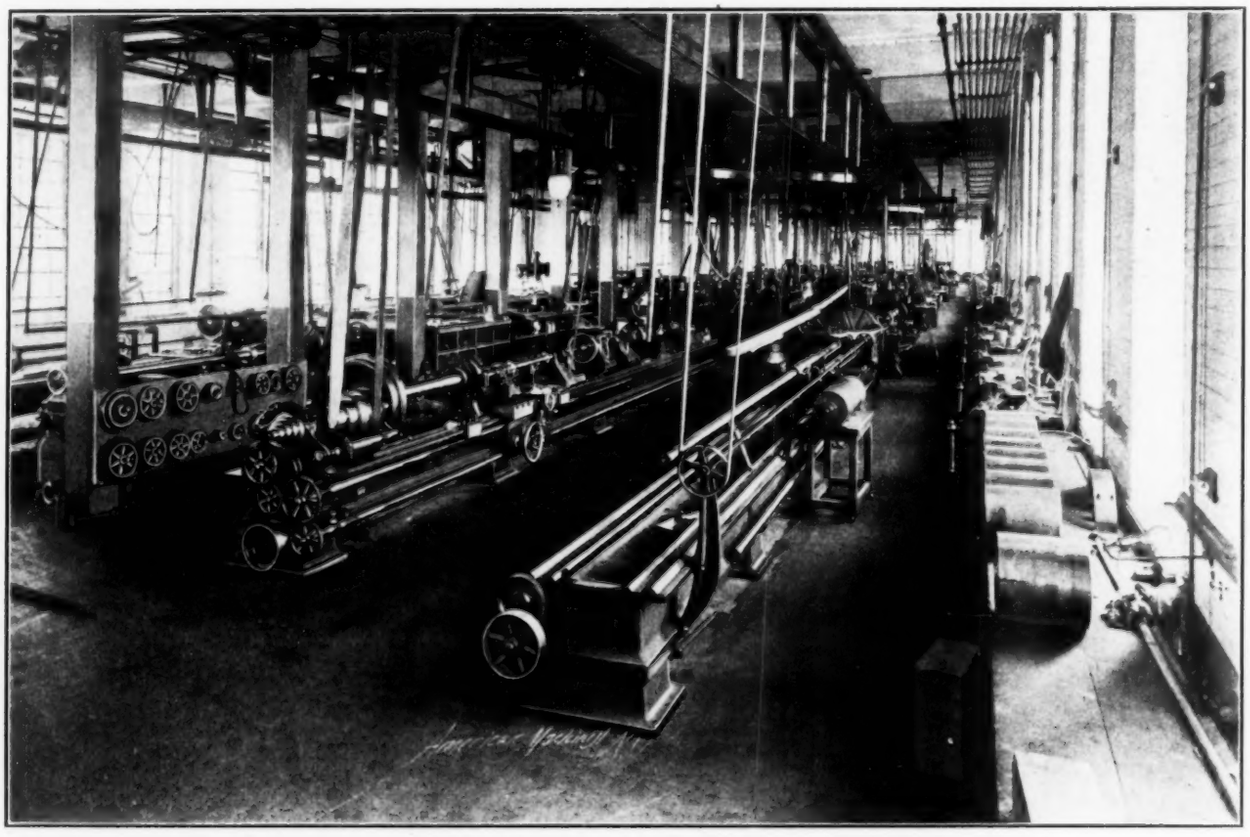


FIG. 22. MACHINING DEPARTMENT FOR TUBES, JACKETS AND RINGS.

tion for the rifling cutter, should a groove have to be recut, as sometimes happens.

The rifling head is shown in Fig. 16. It is of hollow cylindrical form, and is made of steel hardened as hard as possible. A pocket receives a hook cutter, which is positively and automatically forced out and drawn in at each stroke of the bar.

The hollow rod is attached to both head

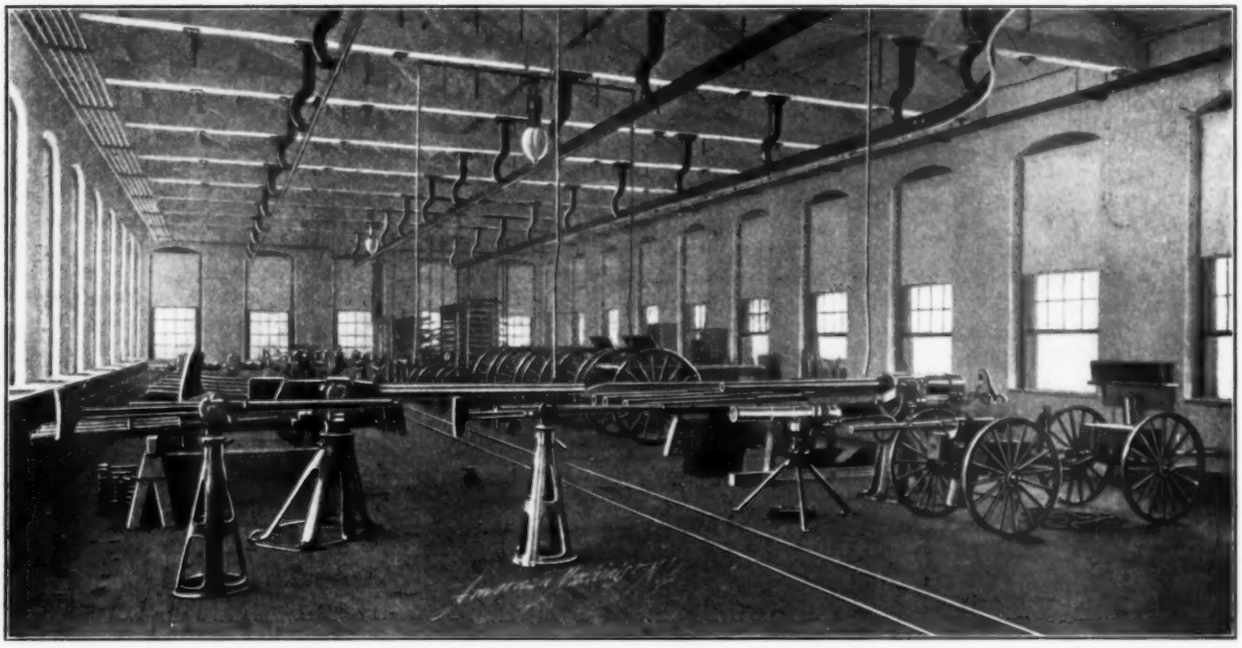


FIG. 23. INTERIOR OF ARSENAL.

and machine in the same manner as in the case of small-bore guns, the only difference being that the rod is hollow to allow the lubricating matter to be forced through it, under pressure from the pump. Animal oil should not be used for this purpose.

The following is a mixture which gives good results: Green's bar soap is shaved in thin slices and dissolved in pure water to the consistency of soft soap; that is, so thick that it will just run. To 1 pint of the mixture 16 quarts of rain water are to be added and the two thoroughly mixed.

Another mixture which gives excellent results is the following: Ivory soap, 1 pound; castor oil, 1 quart; borax, ½ pound; ammonia, 4 ounces. The soap is to be shaved and mixed with the oil over steam heat. The borax is then added and, after cooling, the ammonia. For use, 1 pint of the mixture is to be added to 16 quarts of rain water.

The breech block and firing mechanism of a six-pounder American model Hotchkiss gun is shown disassembled in Fig. 17.

After star-gaging the rifling, the breech is chambered for the cartridges. The gun is swung in the lathe center rest, and the reamers are placed on the lathe center and confined to the same. The depth stop abuts the breech of the gun. The reamers are similar to those used with small-bore rifles, although an additional one is used for roughing out the powder chamber. This operation is a dangerous one, and requires a skilled operator.

The chamber gages are cylindrical, four in number, gaging the different sections, length of powder chamber, neck, connecting curve and the distance from neck to bore. No limit in size is allowed.

PROOF-FIRING.

Each gun is fired six times at short range (about 50 feet) into a sand butt with service charge and blind shell either common or armor piercing. This firing is for the purpose of testing each spare part of the firing mechanism, such as extractors, firing pins, main and sear springs, which may be liable to failure from poor temper, or fire cracks, which do not materialize until the parts are under actual firing conditions, also to test the general working of the gun under fire.

SAND BUTT.

The butt into which the gun is fired is heavily planked at top and sides, forming a wood trench about 20 feet long and 5x8 feet, filled with sand. Stout posts set in the earth are tied together at the top by staybolts to support the whole mass. The face of butt is also planked. Usually projectiles fired from a six-pounder do not enter the sand more than seven or eight feet, though when they meet each other in the sand there are queer happenings. They oftentimes come out, though seldom over two or three feet, and as a result they show up the reverse end, from which they left the gun. The following is one of many happenings at the butt, where a projectile played a boomerang trick: For some (now forgotten) reason the Chief of Naval Ordnance Bureau ordered a six-pounder gun which had passed its proof to be again fired ten shots. Everything except the mounting of the gun was ready at the butt, and hence it required only two of the usual crew of five men to handle it. They were sent to the Proving Ground about an hour in advance of the Lieutenant, Inspector and myself. When we arrived, the gun was found mounted, but no men were to be seen. Said the Inspector: "Those fellows have gone for a drink; we'll just wake them up." He then laid the gun, put in the cartridge, which happened to have an armor-piercing shell, and let her go. And it did go into the butt, and, striking a projectile in the sand, took an upward turn, came up through the planking, glanced against a staybolt and went up in the air two or three hundred feet and came down not over three feet from where we stood near the breech of gun. The Inspector very deliberately turned to me and said without showing the least concern (I believe he was totally insensible to fear), "Rather a close call." The men soon put in their appearance. The Inspector had been correct as to the cause of their absence, but that time they were in luck, as in all probability had they been present when the shot was fired one or the other would have been hurt, as their usual standing place was just about where the projectile fell.

The final operations are the gaging of all parts by the inspector, marking and hand-finishing all over and browning.

For browning, the same process and same appliances, except on larger scale, are used as those described in the article on small-bore rifle barrels. The browning mixture is also the same.

In the description it has been assumed that the portions of the gun not mentioned, such as the breech block with its firing mechani-m and the sights, have all been finished according to the specifications, and have passed all their several inspections. Concerning these parts it may be said, all limb work is drop-forged, and the machining is for the most part done by methods now in common use in any well-equipped plant.

Figs. 18 to 23 show interior views of the

works of the American Ordnance Company, of Bridgeport, Conn., where the guns are made and the operations described are carried on.

The writer is indebted to Mr. E. W. Very, vice-president of the American Ordnance Company, and Capt. Chas. H. Saunders, agent for Hotchkiss & Co., of Paris, France, for facts and data; also to the Pratt & Whitney Company, of Hartford, Conn., for favors extended and courtesy shown.

Water Tube Boilers.

BY W. H. BOOTH.

Some satisfaction is felt among engineers with Rear Admiral Melvillle's report to the Bureau of Steam Engineering as regards his attitude toward the Belleville boiler. As is well-known, this boiler was adopted for the British navy and large numbers of them were constructed with such rapidity that a large proportion of the newest ships were fitted with the boiler and many of them are absolutely helpless. A daily paper that happens, curiously, to be well informed on the subject, refers to the matter as Naval Tuberculosis, a rather apt term for a species of degeneration that involves tubes in rapid corrosion. But apart from the troubles caused by corrosion in water-tube boilers, the Belleville, when new and sound, is unsafe and unsuitable for anything but absolutely non-hydrogenous coal. It is unsafe because its water tubes are always liable to blow themselves empty of water and when empty the tubes next the fires become dangerously overheated before the water returns to them, when they are cooled in possibly too severe a manner, and they fail.

This, of course, should condemn the boiler apart from any other reason, but there are other reasons. In the first place the boiler is wasteful. It burns up to double, or more, the coal burned for an equal result by Scotch boilers. Much has been made of the weight per horse-power. There is much contradiction on this point, but there is good reason to believe that difference of weight is practically nothing. But even if it were of account, the difference of even a hundred tons in machinery would be of very little moment when compared with the difference of coal consumed in going a long voyage. The water-tube boiler fails both in safety and in the item of over-all weight, especially for a country like this, whose different states are separated, or perhaps I should say united, by wide stretches of ocean.

Finally, there is the question of smoke. Now the Belleville boiler will smoke even with so-called "Smokeless Welsh," because it is so constructed that it must smoke with anything from which smoke can possibly be made. Its furnace is so placed that the gases from the fire rise vertically up and pass at once among the mass of water tubes which are supposed to be as cold as the steam in the boiler, but are, I much fear, often red hot, or nearly so. No boiler furnace has yet been made smokeless in which there was not some provision for well mixing the gases from the fire with a further supply of air introduced above the zone of combustion of the solids. And when this provision has been made, there has always been smoke made unless the mixed gases have been able to retain their temperature until they had had time to enter into a state of high combustion. This last, almost all makers of water-tube boilers have rigidly avoided, for, with almost unanimity, they crowd their tubes closely upon the furnace, evidently influenced by the fetish of cramming all the water and heating surface possible into the smallest possible space. This, of course, is the wrong way to go about designing a steam boiler.

The application of the utmost possible surface to the hot gases is plainly a desideratum. Most designers get to this point and go no further: they at once plaster their fires close against the tubes and send their fledgling into the world to do what human fledglings do—to wit, smoke. The thoughtful designer has yet to face the most serious problem in boiler design, for he has got to provide for the conduct of a very complex series of chemical combinations. He has got to secure the combination of the complex mixture of carbon and hydrogen presented him as coal, with oxygen gas. This would be an easy problem, were it not that he only gets his oxygen mixed with four times its bulk of useless nitrogen. The nitrogen serves two bad turns: First, it thrusts itself in between the atoms of oxygen and carbon or hydrogen and delays or prevents their union as effectively as if it were a sheet of metal. Secondly, it reduces the temperature of combustion. If we could get rid of the nitrogen our smoke troubles would be small and probably the worst designed boilers would be satisfactory. But we cannot get rid of the nitrogen and must do our best with gases whose temperature capacity is reduced at least to about a fifth of what it might be, and with the necessities of practice to an eighth or even a tenth.

With these drawbacks we find that in ordinary practice the temperatures of our air and gas at the combustion point, even in fairly well designed boilers, is as low as 1,000 degrees, or even as low as 900 degrees Fahr., and combustion is difficult or imperfect. When the gases rise straight up from the furnace among the tubes, there can be no further combustion possible. The cold tubes prevent this as effectually as cold wire gauze prevents the passage of flame in a miner's lamp, or as the platinum coil of the lecture room is made to carry off the heat of a candle so rapidly as to extinguish the flame in a few seconds. If a boiler designer will think out the matter, he will find himself driven to design on different lines. His first idea will now be to obtain combustion and he will protect the furnace from cooling. To do this he will cease to line his furnace with cold water. It will assist him in his work if he considers everything at its absolute temperature, because he will perceive that so-called hot water at 360 degrees Fahr. is not nearly twice the temperature of ice. The absolute temperature of ice is 491 degrees Fahr., that of 360 degrees steam or water is 819 degrees and the temperature of a furnace at 2,500 degrees Fahr. is really 2,959 degrees Fahr. absolute, or treble that of the steam. Thus the boiler is seen to be a very cold body when compared with even the low furnace temperature of 2,500 degrees Fahr. A furnace must be kept warm, therefore, by means of a lining that will not readily melt and that is a bad conductor of heat. Firebricks fill these conditions fairly well. They are hard and tough.

Having got so far, it must now appear absolutely necessary to provide that the furnace gases shall be mixed up into a fairly homogeneous mixture and provided with a large space in which to burn. The intimate mixture makes it feasible to use the smallest possible amount of air and yet bring the oxygen to the combustible. After completion of the combustion the ordinary water-tube designer may be let loose to crowd in tubes as closely as he can get them in beyond the combustion chamber space. This done, a man of sense may have a turn at putting the bent tubes into more rational shape and arranging them so as to be removable without taking out the tunnel shafting or unshipping the tiller.

Not one water-tube boiler in fifty is designed with any knowledge of the necessities of combustion. Almost all follow the plan of crowding tubes upon the fire. I recently did come across a water-tube boiler of a different order. It was of the small tube type and was called the Weir boiler. It had a furnace practically enclosed with walls of fire-brick, any tubes near the fire being made to serve as refractory walls by being converted simply into columns carrying the brick walls. Quite a large inner space was provided for a combustion chamber and beyond this the gases were maintained in contact with the tube surface until they escaped to the funnel. There was thus provision for a large fire grate, for air admission above the grate, for mingling this air with the gases, space in which the mixture could burn and tube surface to abstract the heat after this was produced and not before it. But the success which has attended this Weir boiler is due to the designer of it having had the courage to provide first what was necessary to success, seeking to modify a successful design afterwards where it seemed possible so to do in the way of reduced bulk.

It is certain that except we design on sound principles we cannot hope for success. Now, I have examined the Belleville boiler in its drawings and in models, and we have Admiral Melville's word that the drawings are enough to examine it by to good purpose, and I fail to see how any engineer at all familiar with boilers or with coal combustion can come to any other conclusion than that the Belleville boiler is bad in principle, is inherently dangerous, is bound to be a smoker and cannot fail of being wasteful of fuel.

There are plenty of water-tube boilers to which all of the above indictments do not apply, but there are few that are constructed with any attempt at perfect combustion. James Watt lived fully 100 years ago. His boiler practice consisted of a boiler with a fire grate placed between two walls of fire-brick. There was a third brick wall at the end of the fire and a brick arch over the front end of the fire. The only cold surface was over the fire, where about a square foot of plate was exposed for each square foot of bright fire. The fire door was porous and admitted air above the fuel on the grate. This porous door was renewed every time the boiler was fired, for it was made up of a heap of coal piled on the dead plate right up to the top of the doorway. Watt's practice was sound, for he allowed all the gases to sweep together over the fire surface and become heated and well mingled and he provided large chambers behind the bridge for further combustion. Watt understood the elements of design better than most water-tube faddists to-day, and this is why water-tube boilers have done so badly and have as a rule miserably failed when set to work with bituminous fuels.

London.

Power Calculations for Gas Engines.

BY HERBERT L. TOWLE.

The indicated horse-power of any engine is equal to 1-33000 multiplied by the product of the mean effective pressure, the area of the piston, the length of the stroke in feet and the number of power strokes per minute. For steam engines this is commonly written:

$$\text{H.-P.} = \frac{PLAN}{33{,}000}$$

in which

P = mean effective pressure in pounds per square inch,
L = stroke in feet,
A = piston area in square inches,
N = number of working strokes per minute.

Given the boiler pressure, a percentage may be allowed for "drop," and an ideal diagram may then be constructed from given data of cut-off, release and compression. This diagram will not vary far from the actual diagram, and the mean effective pressure calculated from it will fall within close limits of error. In ordinary cases, and assuming dry steam, the only disturbing factors are excessive condensation at very slow and wire-drawing at very high speeds.

With the gas or explosion engine the disturbing factors are much more numerous, and it is not possible to predict from the cylinder dimensions, fuel and speed, what power will actually be obtained from a given engine. The most that can be done is to say what power ought to be obtained if the several conditions of good working are complied with.

Leaving such things as leakage and palpably faulty mixture out of account, and assuming also that a full charge of mixture is received at each suction stroke, the three prime factors determining the efficiency of the engine are its compression, the rapidity of its combustion and the rapidity of expansion of the burnt or burning charge. On purely theoretical grounds, and supposing that combustion is instantaneous and that no variation takes place in the other conditions, it may be shown that, the higher the compression, the greater will be the proportion of fuel energy converted into work. A marked gain in economy has in fact followed the general increase in compression since this principle was enunciated; but the other conditions involved by no means remain unaltered with an increase in compression. Combustion is never instantaneous; it is more rapid the higher the compression and the better the mixture. Reducing the clearance space not only raises the compression, but diminishes the residuum of burnt gas which mingles with and dilutes the mixture. Theoretically, this, too, is so much the better, since, other things being equal, the heat should be developed as quickly as possible, in order that the hot gases may get the full benefit of the subsequent expansion before they are discharged into the atmosphere. Practically, however, there may be such a thing as too rapid combustion.

The last point is best illustrated by the indicator diagrams occasionally obtained from slow-running stationary engines of moderate size. The diagram is characterized by a sharp peak, where the combustion curve rises very straight and the beginning of the expansion curve forms an acute angle with it, the two sometimes even joining at the top in a short vertical line. This effect may be due merely to the inertia of a heavy indicator piston, but it is more often the sign of rapid burning and equally rapid cooling of the mixture before the engine piston has had time to move out. As the piston is then moving very slowly, while the gases, by their high temperature and density, are in the best possible condition to give up their heat to the metal walls around them, this effect will be readily understood. It may be said in general that it is never best to make the combustion so rapid as to produce a pointed instead of a rounded peak.

There are two ways of accomplishing this—by delaying or prolonging the combustion and by running the engine faster. Where the latter is undesirable, the ignition may be timed to occur later, the compression may be reduced, or the mixture may be juggled to "stratify" it, or to make it richer or leaner than the normal. Of these, the first two methods are much to be preferred, as the last introduces an element of uncertainty and, moreover, is itself inimical to the best efficiency.

In general, when any two of the three factors, ignition lead, compression and speed, are determined, the other can be adjusted to suit them. The ignition, however, should never occur after the crank has passed the center; nor should it be unreasonably early, as this reduces the effective area of the card. The ideal condition would be an ignition a bare fraction before the dead point, and compression just sufficient to make the combustion curve nearly vertical, but still slightly rounding at the top. Compression should never be carried to the point of causing spontaneous ignition, which with gasoline or rich gas is liable to occur at any pressure near or above 100 pounds absolute, corresponding to a clearance volume under 28 per cent. of that swept by the piston.

Although it is possible to fulfill the above conditions with a very moderate engine speed, still it is from every point of view desirable that the speed should be as high as practicable, both because the engine is thereby made more powerful for its size, weight and cost, and also since, by giving the fresh charge less time to become heated before compression, and by giving the burnt gases less time to cool before expansion, high speed is advantageous from the thermodynamic point of view. This is particularly the case with small motors, in which the cooling area of the walls and head is relatively so great that the cycle of operations must be performed very rapidly, else the heat loss to the water jacket is so great as to necessitate a low compression, with a resulting efficiency much below that of larger motors. It is possible even with quite small motors, say of 3½ or 4-inch bore, to obtain nearly as high a power in proportion to the piston displacement per minute as with diameters two or three times as great, provided that the piston speed be equally high in the former case and that the compression and other features of design be in keeping with the speed.

In general, up-to-date practice in four-cycle engines favors a piston speed of from 500 feet per minute, in small stationary and marine engines, up to 700 feet in large engines and 800 in automobile motors; while speeds upwards of 1,000 feet are occasionally met with in the latter and in special motors.

But it is very necessary to design the engine for its intended speed. The disposition among builders of small motors who have not felt the spur of automobile progress (of which the very head and

front is high piston speed) is to allow their piston speeds to fall off excessively as the sizes grow smaller, and if it be attempted to improve the economy of one of these latter by speeding it up, say, 50 per cent., the result will probably be a mere transference to the exhaust of the excess of wastes formerly going to the jacket. To save this excess, strict measures must be taken to burn the mixture quickly and completely.

Naturally, this involves re-designing the engine. Such matters as the proportions of valves, reciprocating parts, etc., are outside the scope of this article; but it may be remarked in passing that one of the things which will take care of itself at low speed much better than at high is the igniting spark. Not only is a strong spark a great help towards prompt inflammation, but experiments seem to have shown that a stronger battery is necessary to produce a good spark in highly compressed gas than in the open air, owing to the lower conducting power of the former. This is more particularly true with the "jump" or secondary spark, which on other grounds is often considered preferable where the engine's speed is high. Aside from this, the compression itself becomes a more difficult thing to handle as the pressures increase. Small parts of the igniter, etc., projecting into the clearance, will overheat and cause premature ignition if they are not carefully looked after. Projecting corners, especially if cool, will gather carbon deposits, which will in time become so thick as to remain red-hot from one charge to the next, and constitute another cause of premature ignition. A high compression taxes the piston more severely than a low, and especial care is needed in the design of this important member.

In all the above it has been assumed that the compression stroke is begun with a full charge of mixture in the cylinder. As a matter of fact, there never is a full charge in the cylinder when the engine is running near its normal speed, owing to the resistance of the pipes, the vaporizer, ports, passages, etc., through which the mixture is drawn. This is quite apart from the resistance of the inlet valve itself, when this, as frequently in small engines and those designed for variable speed, is opened by suction against a spring. The drop at the valve, when the latter is automatic, is practically independent of the speed of the engine; but the drop due to friction in the vaporizer, passages, etc., is proportional to the square of the speed. At normal speeds it is usually inconsiderable—10 per cent. at most—but at high speeds it may cause a serious loss, both by reducing the volume of the charge and by reason of the resulting diminution of compression and the more sluggish combustion. An accepted rule for mechanically opened inlet valves is to proportion them for a maximum velocity of 100 feet per second of the mixture. Exhaust valves are preferably made somewhat larger, such that if the exhaust gases passed out at atmospheric pressure their mean velocity would be about 85 feet per second. An automatic inlet valve may be made the same size as the exhaust valve.

The path of the fresh mixture should be as short and direct as possible. Even air has inertia, and sharp bends in the air passages are particularly efficient obstructors; while rough cored passages are only a little better. The writer personally considers the obstruction due to an undersized valve as often a very small matter compared with the prolonged resistance of a contracted and tortuous passage feeding it. When the air pipe is short, smooth internally, and free from sharp bends, it may be made surprisingly small, as some French automobile motors testify. With gasoline motors, however, the matter is apt to be complicated by the fact that a certain intensity of flow is necessary to commingle the air and vapor thoroughly, and experimenters frequently find that enlarging the supply pipe actually reduces the power of the engine. With gas engines, owing to the more ready diffusion of their fuel in air, this effect is not so marked.

From the foregoing brief outline the reader will understand the reason for the statement at the beginning of this article, that a formula may be written to show the best result that may be expected from an engine of given bore, stroke and speed, but that no formula can predict the result when the novice tries his 'prentice hand at gas engine designing. Even if the beginner follow a standard design, the chances are that he will do considerable experimenting before the copy equals the original; while if his first engine is to be something revolutionary (as what beginner's is not?), it needs no prophet to predict for his labors a long row and a stony one.

It being understood, then, that the engine is correctly designed, that its speed is neither unreasonably low nor excessively high, that the mixture is good and that ignition occurs at the proper time, the next thing is the formula itself. One way to construct this is to assume that the compression is carried to its most advantageous point in every case, and ignore that factor in common with the mixture, the piping, and the ignition. The case, however, is not quite the same, inasmuch as there is an obvious limit to the improvement possible in the latter points, while, theoretically, there is no such limit to the increase of compression, the practical limit being a matter of premature ignition, intended speed, leakage, etc. Compression, therefore, being made high or low of set purpose, is a legitimate variable and ought to be included as such in the power formula.

The most satisfactory formula of this sort which the writer has met with is one proposed by E. J. Stoddard in "The Horseless Age," September 20, 1899. It is derived from an analysis, partly theoretical and partly empirical, of the indicator card, and, slightly transformed, it may be written as follows:

I. H. P. =

$$\frac{D^2 \times (L+C) \times \left[\left(\frac{L+C}{C}\right)^{\frac{1}{3}} - 1\right] \times N}{9160}$$

in which

I. H. P. = indicated (not brake) horsepower,
D = piston diameter in inches,
L = stroke in inches,
C = clearance volume divided by piston area, also in inches;
N = number of revolutions per minute.

$L + C$, of course, is the total volume of the cylinder divided by the piston area.

The brake horse-power will be from 75 to 80 per cent. of the indicated; so that, taking an average figure for the denominator, we have:

B. H. P. =

$$\frac{D^2 + (L+C) \times \left[\left(\frac{L+C}{C}\right)^{\frac{1}{3}} - 1\right] \times N}{12000}$$

Of course, the engine is supposed to be working at full power. This being the case, it is more convenient to make N equal the number of revolutions; and for the same reason the stroke is given in inches instead of feet. The formula for brake horse-power applies to engines using gasoline or natural gas. If illuminating gas is used, the denominator will be from 12,700 to 13,000, according to the quality of the gas.

The use of this formula may be much facilitated by a table of the values of $\left(\frac{L+C}{C}\right)^{\frac{1}{3}} - 1$, and this is appended.

$\frac{L+C}{C}$	$\frac{(L+C)^{\frac{1}{3}}}{C} - 1$	$\frac{L+C}{C}$	$\frac{(L+C)^{\frac{1}{3}}}{C} - 1$
3.	0.442	4.1	0.601
3.1	.458	4.2	.613
3.2	.474	4.3	.626
3.3	.489	4.4	.639
3.4	.504	4.5	.651
3.5	.518	4.6	.663
3.6	.533	4.7	.675
3.7	.547	4.8	.687
3.8	.561	4.9	.699
3.9	.574	5.	.710
4.	.587		

Two points to be borne in mind when using this formula are, first, that with equal compression a short-stroke engine will usually give less power per unit of piston displacement than one of medium stroke, and, second, that the advantageous limit of compression is generally lower the shorter the stroke. The most economical ratio of stroke to bore is usually considered to be about 1.5, though in small motors this may reach 1.6. More commonly, however, small motors are made with shorter strokes, down to a ratio of 1 : 1 with the bore, for the sake of greater compactness and light weight. Such motors will not usually show quite as good

results as the formula would indicate; while, on the other hand, an engine designed primarily for efficiency will often do better than the formula.

For approximate calculations the compression factor may be omitted, and this enables a very simple expression to be used. One such formula, which indicates what may be expected of a good average engine working on gasoline or natural gas, is

$$\text{B. H. P.} = \frac{D^2 \times L \times N}{18{,}000}$$

in which D, L and N have the same values as in the preceding formula. In exceptional cases the denominator may be as low as 15,000, while in badly designed or very small engines it may run from 20,000 to 30,000. For illuminating gas, instead of 18,000, the denominator should be about 19,000.

By assuming a piston speed, this formula can be so simplified that one can tell directly, on knowing the piston diameter, what any engine should be capable of doing. If for this purpose a piston speed of 600 feet be chosen, we have:

$$\frac{2 L \times N}{12} = \text{piston speed in ft. per min.} = 600.$$

$$L N = 3{,}600.$$

$$\text{B. H. P.} = \frac{D^2 \times 3600}{18{,}000} = \frac{D^2}{5}$$

That is, with a piston speed of 600 feet per minute, the horse-power per cylinder should equal roughly one-fifth of the square of the bore. For automobile motors, the denominator 4, corresponding to 750 feet piston speed, would represent up-to-date practice; while $\frac{D^2}{6}$ would fit the average launch engine, which in this country is still rather backward as regards rotative speed.

The writer has not touched on formulas for two-cycle engines, chiefly because these are such slippery fish to deal with that only the expert would know how to make the results come within gunshot of his calculations, and the expert naturally has his own formulas ready to hand. Still, for the benefit of the beginner who wishes to know "about how big" to make his engine, the following formula, from "The Gas Engine Handbook," by E. W. Roberts, may be quoted:

$$\text{B. H. P.} = \frac{D^2 \times L \times N}{14{,}000}$$

If gasoline is used, the denominator will be 13,500. These should be regarded as maximum rather than average values, and 15,000 would not be too large a denominator under ordinary conditions.

Echoes From the Oil Country.

GOVERNORS.

"Joe, take this Gardner governor over to the grist mill and put it on."

Joe shouldered the governor, which was a 3-inch one with safety attachment, and left. In a few minutes he returned with the pulley shaft, and said it needed 10 inches welded on to bring the pulley out far enough to line with the pulley on the engine.

We had ordered the governor for the mill, as their old one had given out, but we were not acquainted with the condition of things at the mill that would require such a long shaft. Joe explained that the engine was a side draft, that took its valve motion from an arm keyed to the outer end of the wrist pin, and that the steam chest was on the outside of the cylinder, so that the shaft had to reach clear across it.

The piece was soon welded on and turned up and sent over to Joe, and in due time I went over to see things running, and told the engineer to run just as slack a governor belt as he could, on account of the strain thrown on the bearing by the long shaft.

About eight or nine weeks later Mr. Smith came running in one day, very much agitated, and said that the grinding burrs had blown up and wrecked things badly at the mill; that the governor belt had broken and the safety attachment failed to work; the engine then ran away, with the result that all sorts of damage was done. Furthermore, the owner proposed to hold us responsible, as I had told him the safety attachment would prevent just such a thing, and that was one reason for throwing the old governor out. The engineer was fireman and miller both, and could not watch the engine much.

Calling Joe, I started on the run for the mill. I found that the plaster tops of both burrs had been thrown off by the velocity, that one side of the mill was knocked out, both burrs ruined, shafts bent and general havoc made.

We made our way through the ruins down to where the engine stood, and everything was clear. The engineer had taken a board, bored a hole the size of the governor shaft through it, slipped it over the shaft and nailed the end securely to the joists above the engine, making a very good bearing for that end, and also a very good way indeed to keep the automatic stop from working. I had explained and shown him the action of the stop when the governor was put on, but he had evidently forgotten all about it, and couldn't see why a new governor like that failed the very first time it had a chance to work.

We haven't been called on to settle yet, or been sued, but the same engineer is running the repaired mill. You can't always get a big, strong man, that can fire, and run the engine, fill bags, grind and keep up the repairs, for $2 per day.

. . . . . .

"Say, Osborne, I want a man over to my place right away; my engine wont go."

"Oh, I don't know what is the matter. It just took one of those cranky streaks, that all machinery does, and quit. I think you fellows make things that way, so you can get work to do. That engine worked yesterday, and to-day it won't start. It will turn part way over and then stop. I have been fussing with it for two hours, and got mad enough to smash the blamed thing to pieces. Let me have a man quick, as my men are standing around waiting."

"Sammy, go over to the handle factory with Mr. Davis, and see what his trouble is."

It was only a short distance, and Sammy soon returned, with a broad grin on his face.

"Only a square peg in a round hole," he said. "Davis thought his governor belt was getting too loose, and so last night, when he shut down, he took a piece out and put it on again without raising the automatic stop on top of the belt, and didn't get any steam in, except what leaked past the valve. I had it fixed in about a minute with him standing by me, and he didn't see why that should make any difference, as that thing was only a fulcrum for the lever with the ball on. You know, he is getting along without any engineer now. I think he had better go back into the office, and let one of the kids run the engine."

. . . . . .

This was a governor of a different make. It was a good high-speed governor, about a year old, a 4-inch one, and it used to hold the engine nicely. Then things began to work strangely. Everything would go along very well for perhaps hours, or even days; then things would hum, and the engine would run so fast that the engineer had to stand at the throttle constantly. Then, again, everything would drag, and a full throttle and 10 pounds more of steam wouldn't run things up to speed. As this was in a flour mill, a roller mill, you can see there was trouble. The engineer had gone over the engine and governor several times before saying anything.

I sent Billy over, and he spent half a day without finding anything worse than a little slack, which he took up, and left everything running nicely; but he had hardly got back when word came over that she was on a rampage again, and he went back, but found nothing. Then the engineer came over and had a long talk with me, explaining the engine and governor, but failed to help things any. Finally, I went over and looked things over and could find nothing. Valves in good shape, and no chance to move; eccentric set right; governor free and working nicely.

On putting things together and starting, everything was lovely. I was just going to leave, when the fun began; first fast, then slow. I tore off the governor top and everything seemed in its place. Tried again, same result; as soon as things got warmed up good, there was trouble.

I sat down and thought over everything carefully, and made up my mind that the trouble must be in the governor valve. I tore it apart again and tried it. The

seat was pressed in, and it seemed tight, as far as I could tell by trying to move it with a couple of packing hooks. The next time we got things running she slowed down and nearly stopped, and I shut down and tried taking her apart again. It took a strong pull to lift the top off, and seat and all came out together. The seat was sticking fast to the valve and the openings were nearly shut.

I found that the seat had been loose enough to move a little and the engineer had caulked it. The valve was free to move around on the stem, and at one place would stick. If it got there when the valve was wide open, it prevented the valve closing readily, and when it was forced shut, it would bring the seat up with it. When everything was cold, it would go in any direction freely and would drop apart before the governor was torn apart. The live steam surrounding the valve seemed to make it enough hotter than the seat, which had the body of the governor to carry off some of the heat, to make this difference. I couldn't understand why the expansion of the seat didn't make it tight enough to hold in place. However, caulking the seat in securely and filing the valve a little stopped all the trouble.

. . . . . .

Sammy was sent out to babbitt a saw arbor, and was about done when the boss came around and asked him if he could set a valve on the engine. Of course, Sammy said yes. He would have said that if he had never heard of a steam engine before, and trust to his wits to find out how to do it when he saw the engine. He was not lacking in confidence, and generally "got there" in some shape.

He found that the engineer had taken the eccentric rod off and straightened it, and so had thrown the valve too far back. To set it in place was a short job, although, as the men were all standing around, he spread himself a little, and made the men pulling her on to the center back up several times and come up more carefully when they got a hair too far. He wanted to keep up the reputation of the shop and show those fellows that it was a risky thing to monkey with an engine, unless you were a machinist in good standing.

The engineer had taken advantage of the shutdown to take off his governor and soak it in lamp oil.

When things were ready to start, Sammy waved the men all back, and, with an air of importance, began opening the throttle. The engine started and with full throttle ran at about 90 revolutions; 150 was the speed. When the work was thrown on, things nearly came to a standstill.

Climbing on to the boiler showed that valve wide open. The boss began to swear and the men to laugh. "I thought you knew how to set a valve," came from the boss; and one old fellow, with his mouth full of tobacco, growled out: "They ought to know better than to let a boy like that fool with an engine." The boss was for starting a man to the shop for someone that knew something, and directed the man that ran the saw Sammy had babbitted to watch it carefully, as he didn't believe the job would be worth a cuss.

All this did not add to Sammy's peace of mind, but he kept his head. He had marked the eccentric, a thing he always did in setting a valve, whether he moved it or not (they are held by set-screws on the small engines) for the sake of future jobs, and he found it all right and then began looking over things carefully with the engine crawling along and the throttle wide open.

On looking over the governor, he found the pin had dropped out of the piece above the spool on the valve stem, letting the stem drop down so as to nearly close the valve. He stuck a chisel under and pushed it up to its place. The engine nearly jumped from its foundation, and the men, who had been standing around grinning, nearly fell over each other trying to get out. As he closed the throttle, Sammy heard a hoarse growl from the old chap, who chanced to be one of the last to get out, "Gosh, he does know something after all."

The babbitted box ran all right after that, but Sammy is bending his energies to coax the hair to grow on his face, so he won't be taken for a boy any more. He is past seventeen, and has been almost two years at the trade.

. . . . . .

I had been up in the lumber woods nearly a week repairing the big engine. I tested it to their entire satisfaction, had gotten my supper and was just climbing into the buggy to be taken to the railroad station, when I heard a racket down at the mill. They were running and trying the saws, and, seeing that everything was in good shape in that direction, and a man came running up and said the engine had run away. I went down and found that the engineer had managed to shut down before any harm was done, but he was scared. "Everything was running just as you left it, when all at once she just began to sail, and the governor didn't seem to take hold a bit," he explained.

The belt was in place and everything right there. I lifted up on the balls and found they struck the valve against something. Taking the top off the governor showed a piece of bolt with an end through the valve, and the head keeping it from getting clear through. The engineer had put in a new gasket in the steam line up near the boilers. He had to cut the nuts off, and in some manner this bolt had got into the pipe. Just how he managed to get it in, I do not know, but he recognized it as soon as he saw it, and he begged me not to give him away. He was a good careful man, and a mill is a place where the men have long memories, so I dropped the piece into the creek and went my way. W. OSBORNE.

A Magazine Feed for the Automatic Screw Machine.

BY MIKE ROMITUR.

Shop managers and foremen are continually installing time and labor-saving automatic machinery to cheapen the cost of production. Time, tools and power are the great items of cost to a concern in business for money, and anything shaving the cost of one or more of these without adding proportionately to the rest is what the wideawake fellows are after. The following article may strike some of these same fellows in the right spot: it is a tool which, though not widely known or used, will be found valuable in almost every automatic screw-machine department. It was originally designed for the Pratt & Whitney type of machine, but can be adapted for some of the others. It takes pieces of stock (round), already cut to a given length and feeds them to the screw machine, to be drilled, bored, tapped or formed on the end, etc., as the case may require. This admits of greater accuracy in the length of the finished piece and also of working on the unfinished end of a half-finished piece. The cutting-off operation can also be done more quickly in a powerful automatic cutting-off machine, or in a milling machine rigged up with a gang of cutters to cut several blanks at a time.

Fig. 1 shows a view of this tool, or magazine, in its place on the cross-slide, looking from the turret toward the head of the machine. The cross-slide is shown pushed forward by the cam lever, so that the first piece to be machined—that is, the lowest blank in the magazine—is in line with the chuck. The foot for the magazine, which takes the place of the tool post of the machine, is simply a cast-iron angle plate of the proper dimensions, with the top plate planed at an angle of 45 degrees with the base. The base has a tongue planed to fit in the T-slot of the cross-slide, so as to keep the magazine in alignment with the machine after being once properly fastened to the foot.

Referring to Fig. 2, we have a sectional view of the magazine with the cover on, and the blanks inside. Note the clearance space at the ends of the blanks. This should be enough to clear all nibs or burrs that occur in the cutting-off operation, and to allow the longest blank to drop in freely. The remainder of Fig. 2 is a diagram showing the spring steady rest *D* and the method of making the long lid detachable, which is desirable in case of an obstruction caused by chips or an extra long piece of stock. In Fig. 1, at the extreme top, the lid is shown bent over so as to make a good finger hold. Pulling the lid slightly upward by this, brings the screw heads *A* over the large holes or eyes *B* and permits the lid being readily lifted off. The part *C* is not made to be removed.

The spring steady-rest D is made from

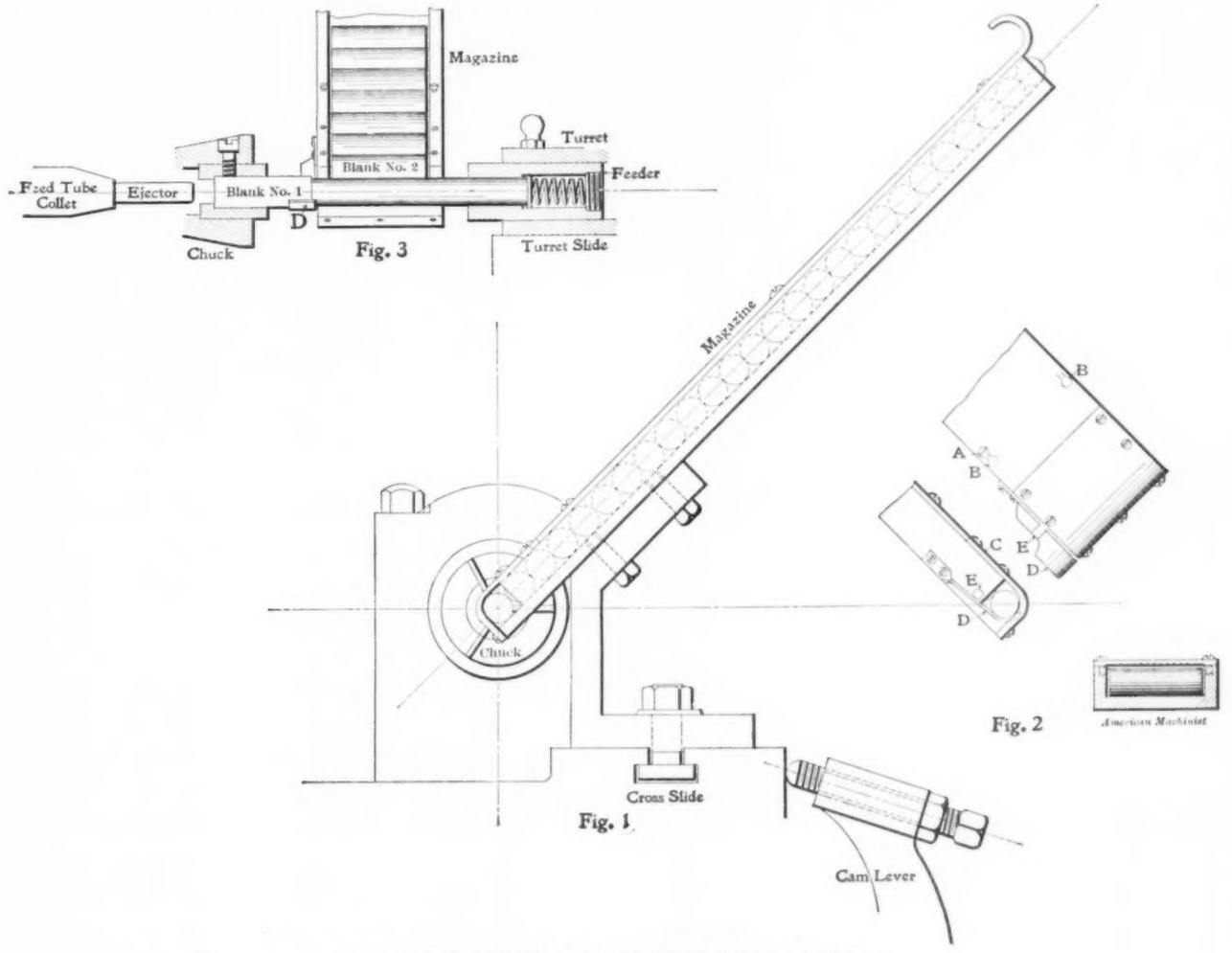
a piece of sheet steel cut out to the proper form, given a quarter twist, offset, bent, tempered and screwed on in position. The pin *E* acts as a stop to keep it from springing up too high. Its offices are to guide the blank from the magazine into the open revolving chuck, true it in said chuck while tightening, and to bend down and leave the work in the chuck during the back travel of the cross-slide. This back travel is effected either by a stiff spring whose pull or push is against the cam lever shown in Fig. 1, or by the opposite cam lever. A nice final adjustment for concentrating the work with the chuck may be obtained by the adjusting screw in the head of the cam lever.

The feeder, Fig. 3, is held in the turret the same as any ordinary tool or toolholder, and has a spring buffer arrangement, as shown, to insure the work being pushed up against the back of the chuck jaws, which act as a stop.

The ejector is simply a piece of round stock fastened into the split collet on the feed tube, which pushes the work out after each series of operations, instead of feeding the stock along through the hollow spindle against a stop in the turret.

The magazine in Fig. 3 is shown without the detachable lid or the piece *C*, for clearness' sake.

The operation is as follows: The machine being in motion, the chuck empty and revolving, the cross-slide moves forward till the blank in the magazine lines up with the chuck; then the turret slide moves to the left and the feeder pushes blank No. 1 into the chuck, as in Fig. 3, and is then withdrawn, allowing the stock in the magazine to move down, blank No. 2 taking the place just vacated by blank No. 1. The cross-slide then moves back and the various operations are performed upon the work, which is finally ejected by the movement of the feed tube to the right, and the machine is ready for blank No. 2.



A MAGAZINE FEED FOR THE AUTOMATIC SCREW MACHINE.

A School in Tool Making.

The Mechanic Arts High School, of Springfield, Mass., held an exhibition of the work done by the students, the evening of March 27. The work of this school appears to be of a higher grade than is usual in trade schools. Special attention is given to tool making and some previous knowledge of machine work and mechanical drawing is required on the part of the students.

The work appears to be very practical. A series of exercises in tool-making is given to each student, this series comprising such articles as mandrels, reamers, parallels, milling cutters, gages, taps, dies, punches, etc. The equipment of the school for such work seems to be first class. The work is done in the evening. Instruction in mechanical drawing is also given in other departments of the school.

Tuition is free to residents of Springfield. To others the fee is fifteen dollars per year, with an additional charge of five dollars for incidentals.

Consul Hughes reports from Coburg that a commission of the German Board of Trade has considered the question of the establishment of a new information office for foreign commerce, to keep pace with other countries. It is not to supersede, but to complete, the old one.

A recipe for a wash for disinfecting the walls and floors of shops is given by "La Revue Technique." It consists of 10 liters of water in which are dissolved 1,000 grams of chloride of zinc with 30 grams of hydrochloric acid. The hands should not be dipped in it.

A Simple Hydraulic Press.

We illustrate herewith a hydraulic press which seems to have been reduced to its simplest elements. The press proper, as shown by Figs. 1 and 2, consists of three principal parts only—the frame *A*, ram *B* and the platen *C*; the usual rods with nuts, washers, etc., being dispensed with in favor of a construction which makes the base, the uprights and the top of a single piece, which is bored at the top, as shown in the drawing, to receive the platen *C*, at the bottom where the ram *B* fits, and faced off on the upper surface of the openings for the platen *C* to form a seat, as shown in the vertical section at the left of Fig. 2. The plate on top of the upright is simply to hold the platen in place when pressure is removed from it. The stem on the lower part of the ram is turned to fit the bored seat in the frame by means of which the ram is accurately guided, and the drawing therefore shows absolutely all there is of the press, it being adapted for use in connection with any suitable force pump. It is apparent, of course, that this construction secures great rigidity, and we understand the press is used particularly for hobbing dies used in jewelry manufacture, and for similar purposes where a hardened hob is by great pressure simply pressed into the die cold to form the impression. The press is made by the Charles Burroughs Company, Newark, N. J.

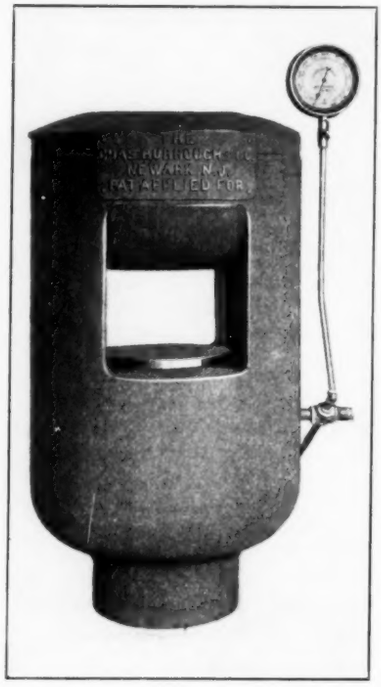


FIG. 1. A SIMPLE HYDRAULIC PRESS.

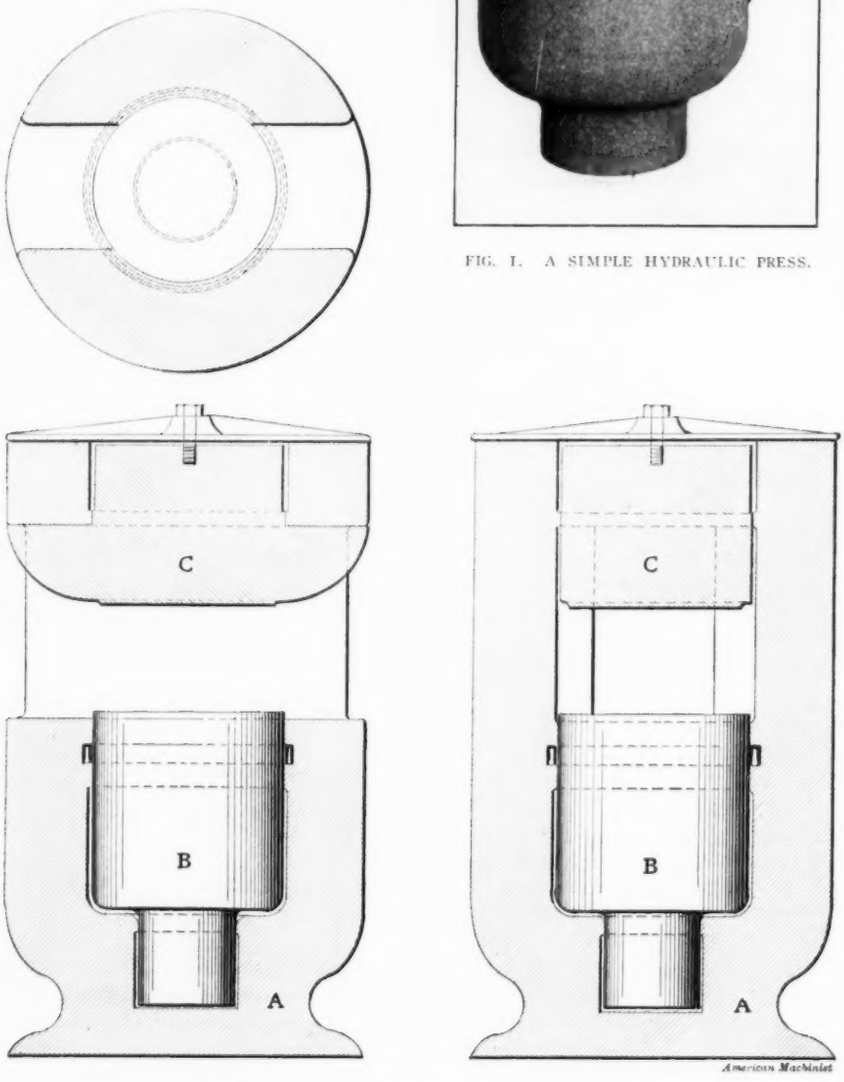


FIG. 2. SECTIONS THROUGH HYDRAULIC PRESS.

Letters from Practical Men

Cooling Tools by Compressed Air.

Editor American Machinist:

Referring to Mr. L. O. Danse's scheme (in issue No. 9, 1901) of using compressed air on a gear cutter: I was employed at one time in cutting grooves, ¼ inch wide and ½ inch deep, around the faces of steel tires for locomotives, on a heavy boring mill; of course using two tools, the one taking the heavy or first cut being on the right hand of the machine, so as to let the tool spring a little if the cut proved too heavy. The other tool was a small spring tool inserted in the end of a large bar, and just taking a sizing cut. But this is not what I started to tell. I found at first much difficulty in getting the chips out of the way of the tools, so I attached a piece of rubber hose to the air hoist above the machine and let the air run into the groove in front of the tools. I not only found that it blew the chips out, but, by keeping the tool comparatively cool, I could put on a little faster feed, saving about eight minutes in each groove cut in a 5-foot tire. I eventually put a cock in a piece of gas pipe, and inserted it in the rubber hose, as I could thereby direct the stream better. The air we used was 80 pounds pressure. APPRENTICE.

Saving Without Economy.

Editor American Machinist:

The John Smith Manufacturing Company have a nice comfortable business in a certain specialty, besides which they do a little jobbing now and then; but, as their specialty is quite profitable and there is little competition in it, they make money on the whole. None of the firm are practical mechanics, except that they have picked up some things since they bought the business; yet they are shrewd, economical people, who study to save in small things as well as in the large ones. Of course they don't keep a draftsman. Why, any of the firm can take his pencil and make a good enough sketch on a stray piece of wrapping paper. If it isn't quite right, they will find it out; mistakes will happen once in a while, anyway. They have tried a number of foremen in the past. Some wanted too much money, others wasted too much, and a few didn't seem to properly appreciate their system; so, as the office overlooks the shop, they get along without the leading man and do their own overseeing—when they are there.

Out in the shop there's a penny-in-the-slot machine. By putting in a stamped check the workman can get a can filled with oil, no more, no less; for that check prevents waste, you know. Speaking of waste—the kind to wipe with—there's several kinds, by the way; who but a spendthrift would ever buy the machine-picked, white cotton, when he can get the dark-

colored, dirty, doubtful variety for a penny per pound less, even if it does feel to the hand like a bunch of blackberry briars.

A dilapidated soap box, or a headless nail keg, surreptitiously kept in the vicinity of the shapers or drill presses, is mutely suggestive that luxurious laziness at such work is not tolerated. The bolt box kept under the planer, partly filled with chips, old castings—for packing pieces—and the usual collection of bolts minus nuts, ditto threads and often heads, shows at a glance that no surplus funds are expended on its contents.

Some of the work is rather heavy, and it would delight the heart of an old-timer, accustomed to things before cranes and jacks were invented, to see the gang collect at call to help push or raise, as the case may be, machinists of high and low degree, errand boy and leading man—everybody who can get a hold and lift a pound. Probably the collective time taken together for one of these "lifts" wouldn't have paid for a suitable lifting mechanism.

Yet the John Smith Manufacturing Company, as before stated, made money, and in due time they found it desirable to move into larger quarters, and in so doing they decided to modernize their establishment, adding pattern storage, stock, and tool room. Hitherto these matters had largely adjusted themselves by chance and vacant space. True, the leading man had keys to certain closets, but what they contained would be as well appreciated in a curiosity shop as in a machine shop, especially if the curiosity shop had a large junk attachment to it. Jigs and fixtures had reposed about the machines upon which they were used, or, if too numerous, were shoved under the nearest bench, where, in company with several hundred pounds of scrap iron, by courtesy termed arbors, and a large and varied collection of broken drills, taps and old files, they stayed until patient and diligent search, when again wanted, brought them to light.

Vacant places along the posts and walls had answered for clothes closets. Dust, whitewash and oil spatter on the clothing of the men and stamps them as being workingmen; but the new shop was to have closets, and it had them—with calico fronts! Pattern storage was made up of undressed hemlock lumber, strong enough and rough enough, but men must not mind such little things as slivers, and looks don't count. The toolroom was to have been fenced in four feet high and a wire netting for the remaining partition, but the fence alone will probably answer. A chalk mark would have been even cheaper. The lumber used in the toolroom and stockroom was pine—don't know what grade or where it grew—never thought trees could have so many limbs growing in so many directions at once, as these knots showed evidence of. No doubt it was cheap.

Well, the job of moving is over; the old belts are patched and pieced up again; the leaks are calked in the burnt out old steam pipes; the machinery is set up and another start is made. Anent the lumber—and very applicable to some other things—the old carpenter, with dissatisfied eye on his last job, remarked "It's just a step in the rear of true economy."

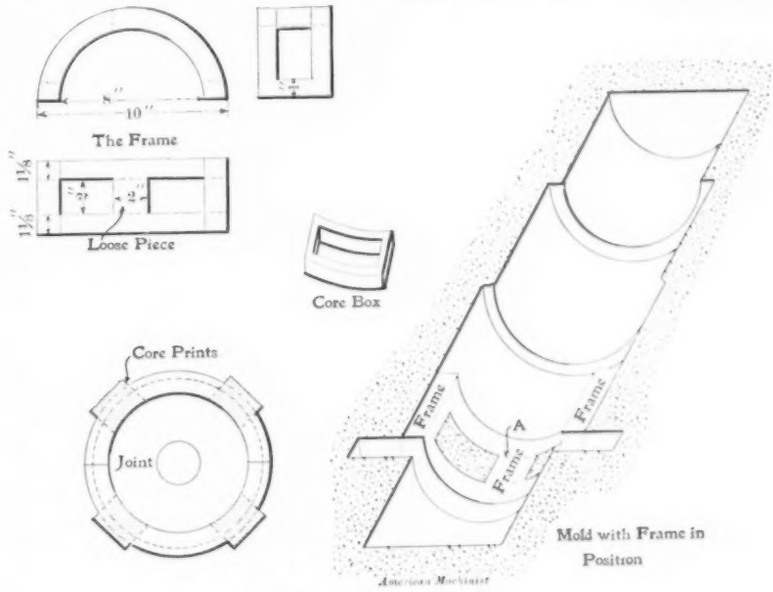
W. E. W.

Improving the Molding of the Special Casting.

Editor American Machinist:

Referring to "Hobo's" letter on "A Special Casting from a Regular Pattern," page 181, he seems to have overlooked one of the first principles taught in the pattern shop, viz.: that of draft; for that frame of his can't be drawn out of the mold without tearing up a part of those two green sand cores. If the portion which I have marked *A* was loose, the frame could be drawn, and the loose piece slid along the bottom of the mold until clear of the cores. However, I don't believe that the frame way is the most economical and simplest plan. In preparing similar patterns that I have, prints are nailed on the pattern to locate the position of the cores, and a single corebox is made, and the dry sand cores are nailed into the mold. Making that frame is more than equal to the making of two coreboxes, and not anything near as safe.

G. B.



ANOTHER WAY OF MOLDING IT.

Babbitt Rings and Ledges.

Editor American Machinist:

Perhaps it is rather late to bring up last century matters, so throw this away if you like.

I notice in No. 50 of last year that "B. W. F." criticises my remarks about babbitt rings and ledges. I took it for granted, when reading his first article, published in No. 41, 1900, that the reason for boring the rings was solely to have them act as a chuck for babbitting the shaft boxes, but of course did not know that they were bored larger than the shaft. Possibly that was the easiest way to chuck the babbitting mandrel; although I think I would have found some other way of doing it, as I would not have had any rings to bore.

He asks if there is anything better than ledges for holding the babbitt, and if I expect the babbitt to adhere to the plain surface of the casting. As he says, the ledges made as he makes them are not objectionable on account of wearing into the shaft, but they make extra work for the molder, and are very much in the way when the babbitt has to be taken out.

I have for years had boxes made with anchor cavities cast in them a little below the joint—in large boxes rectangular cores about ¼ inch thick and ¾x2 inches or more in width and length, with a couple of small nails baked in them to hold them in place. The smaller boxes have flat disk cores secured in the same way with one brad or nail. I never thought it took much to hold babbitt in place—it *is* often difficult to remove it.

Hoodoo.

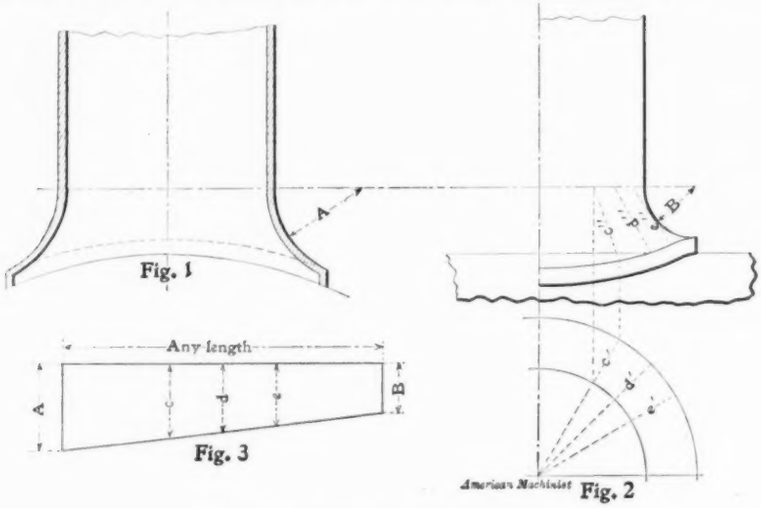
The Working of Varying Curves on Patterns.

Editor American Machinist:

The sketch, illustrating the meaning of the above title, represents one cylindrical piece seated on another of larger radius, with their axial lines meeting at right angles. It is plainly seen that the radius of curve *A* differs from that marked *B*. I can imagine how "that tired feeling" would take hold of the patternmaker who was ordered to make a pattern and corebox for this job, and who knew of no way of correctly shaping the flange part at any point. For such a person this description of my practice is offered.

A diagram similar to Fig. 3 may be laid out on a board, with the ends measuring the same as radii *A* and *B* on the pattern. The length of the diagram is immaterial, but, having decided what it shall be, it may be divided into as many parts as the nature of the work requires, and then the ordinates, as *c, d, e,* will give the radii in the different points.

Suppose the pattern was only 6 inches in diameter, then one division, as at *d*, which is in the center of the length of the diagram, and would call for each quarter-circle of the pattern to be divided once, or at an angle of 45 degrees, would be enough; but larger work would call for the application of molds at more points on its circumference; *c* and *e* would divide each quadrant into three equal parts, and so on indefinitely. There being no limit, the workman would know how many would be required in each case, to insure a good job. By adding the thickness of the metal to the various radii the curves for working the corebox are found.



WORKING VARYING CURVES ON PATTERNS.

WM. NEWTON.

The Work of Manual Training Schools.

Editor American Machinist:

Does the manual training school accomplish its purpose? Is the amount of time spent by students and instructors wasted? If we believe the statement that "when the simplest question was asked him (the graduate) about the subject, he could not answer it," then must it be true that manual training is a failure and the time spent by student and instructor is for nought?

May I ask my shop friend a question? Did you ever have a boy start to serve his apprenticeship with you and when "half through his time" decide that he knew more about the business than you and get a position elsewhere?

Suppose we follow this boy. He immediately begins to tell his new employer how you did not do your work, believing he is explaining the methods employed. Your work, estimated by this young man's knowledge, might possibly be condemned by your competitor, did he not know the class of work done by you.

The manual training school is not exempt from these examples. We have boys who stay one or two years, believe they know all that is necessary, and leave to show what little they do know to some shop man who is unfortunate enough to employ them.

The boy who serves an apprenticeship has to serve ten hours per day, six days per week, for three years of fifty-two weeks each—a total of 9,360 hours. The amount of time devoted to manual training varies in different schools. In mechanical drawing, the average time spent is four periods per week for four years. Periods are usually forty-five minutes long. For wood work, ten periods per week is the average time given for one year; while ten periods per week for two years is a fair average for time devoted to machine shop work. The school year is not fifty-two weeks long, for about sixteen weeks are devoted to vacations, which cut the working time to thirty-six weeks.

With these data we find that the full amount of time spent in mechanical drawing is 432 hours, or fifty-four days of eight hours each. How many chief draftsmen would be willing to take a boy and agree to teach him the essentials of mechanical drawing in two months?

The time spent in wood work—ten periods per week for thirty-six weeks—amounts to 270 hours, or twenty-seven days of ten hours each. One-third of this time is devoted to joinery, one-third to turning, and one-third to pattern-making. Where is the patternmaker who will agree to teach the art of pattern-making in nine days?

Suppose we follow the boy into the machine shop. He probably spends more time here than in any other department. Here he works ten periods per week for two years, a grand total of 540 hours, or fifty-four days of ten hours each—about two months of time, as reckoned from a machine-shop standpoint. Can we expect him to be a journeyman after completing this study?

The machine-shop foreman will tell you he can give a boy only a start in two months, yet this same man will expect much of the manual-training boy who comes to him. Has that two months of service been of any value to him? It must have been. If not, why is it that one of the leading machine shops of this country—one whose work is accepted by all as being on a par with the best the country produces—allows graduates of manual training schools six months when serving their apprenticeship?

I was talking with a leading machine-shop man to-day, who made the remark that "these boys"—referring to a group of manual-training students—"if they follow this line of work, will in the course of five years be far in advance of the boy who is now growing up in the shop, but who lacks their training."

Let us now go back to the boy for a few more thoughts. Did you ever see a boy who did as little as possible and get along? Oh, yes! You know him. He went to school with you. He did not hesitate to copy your arithmetic or algebra paper and pass it in as his own rather than solve the problems himself. He probably graduated; yes, went through on the lowest possible average.

Human nature has not changed. We have boys who do the same thing, and one of those boys probably came to you for a position; said he had been graduated from the So and So Manual Training High School. You hire him, find what he cannot do, and then judge the school by this boy's ability.

What about the other boy, who worked hard and endeavored to get all there was out of his course? Here are some extracts from letters written by some of the employers of these boys to a manual training school in one of the New England cities: "I did not suppose it possible for a boy to come out of the high school knowing so much of drawing and shop processes." "I should say that the young men at your school are given theoretical knowledge and at the same time, what is of most vital importance, taught to practically apply it."

Numerous other testimonials of the work done by the different manual training schools of the country may be obtained by consulting some of the men who have had the graduates in their employ.

Study the conditions under which the manual training teacher is working, before criticising the character of the work.

I sincerely believe that the manual training teacher should have theoretical knowledge supplemented by a good, practical experience; for it is the application of theory he is called upon to teach.

Z. Y. X.

A Business Chance.

Editor American Machinist:

My work of late having caused me to spend quite a good portion of my time with the brick makers and glass manufacturers, I have had an excellent opportunity to study grinding machinery and clay-working machinery from the standpoint of the man looking for a business opportunity on the small and conservative scale—an opportunity that some of your readers are looking for—a business affording a good margin of profit. The manufacture of the above line of machinery has the best outlook for the man with moderate means and good mechanical ideas of anything I have seen for some time.

Pursuing the investigation farther, I went to one of our foundries and machine shops the other day and I saw a small grinding mill just ready to ship. It was what is called a "chaser," and is of the type the glass manufacturers use for grinding the material used to make the pots and large brick for the furnaces. I was told that they sold nearly 100 of that type, and that they nearly lived off the repairs needed for these mills, and this is no small concern, either, as they build, among other things, an up-to-date engine. Their plan is to sell the new grinder on a small margin of profit and charge "to beat the band" on needed repairs.

Then there is the larger type, used to crush and grind sand rock for making sand for the manufacture of glass. The way these machines grind themselves away would make the average foundryman laugh. Grinders for fire-clay go for the cast iron very fast; then we have the grinders and pug mills for the building brick-yards and soft-mud machines for making brick, which also rapidly wear away the metal. Now, furnishing repair parts for these is where the profit is.

If I was to tell you what the manufacturer charges for repair parts for a certain soft-mud brick machine, you would surely ask if they were machined all over, and polished, too, when, in fact, they are just ordinary rough castings with no machining. There is ample room and opportunity for improvements in soft-mud brick machinery, as I have seen no designs that I would consider to belong to good practice. In the manufacture of this class of machinery, it is not necessary to have a very elaborate machine shop, as there is not much machining to be done, and that that is done you will not need to take the micrometers from the plush-lined box to test for accuracy. Another very favorable point is that when you make a sale of a grinder, a pug mill or a brick machine, it is a sale, and stays sold, and the purchaser expects to see it wear out; and in this he is not disappointed, but orders the needed repairs from time to time, and does not complain. Suppose you sell a high-grade engine, you have to play "daddy" to that engine year in and year out, and you will sometimes have grave doubts as to whether it is sold or is going to stay sold.

To be sure you would want a foundry, too, and by keeping on hand sifting plates, scrapers, sweeps, tires for the mullers, false-bottom plates, crown gears, small bevel pinions, etc., for the grinders, knives for the pug mills, and a hundred and one things for the brick machines ready for immediate shipment, I have no doubt but that a very profitable enterprise could thus be started. MUD LARK.

Making Patterns for Thin Rings.

Editor American Machinist:

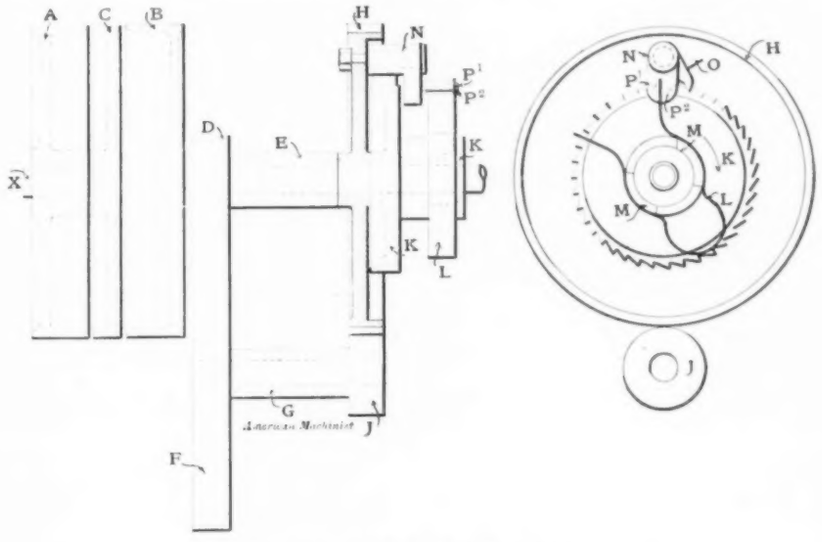
Referring to the article on page 177, by Mr. John M. Richardson, "Making Patterns for Thin Rings," in making the joint *D* I should think the thickness of the saw blade would play an important part in determining the strength of the tongues, and I should think it would require in some cases a saw as thick as ¼ or even ⅜ inch. Mr. Richardson's article was of particular interest to me, as I have a great variety of patterns to make from time to time. W. L. M.

Two-Speed Gear With Silent Pawl.

Editor American Machinist:

In looking over my notes, I come across an idea in the shape of a two-speed gear with a silent pawl. It was sketched from a sizing machine built by Messrs. Howard and Bullough, Accrington, England, many years ago.

X is the driving shaft and to it are fastened the pulley *A* and the ratchet wheel *K*. *C* turns freely on *X* and is by key and spline attached to the pinion *D*. *B* is a loose pulley mounted on the hub *C*. *E* and *G* are bearings. *H* is a spur gear turning freely on *X* and having a stud and pawl *N*. The hub of *K* is grooved to receive the spring *L* and the leather strips *M M*, which are riveted to *L*. *P*1 *P*2 are pins driven into *N*, and between them passes the end of the spring *L*. *O* serves as a stop to the pawl *N* by striking against the inner rim of *H*.



TWO-SPEED GEAR WITH SILENT PAWL.

Suppose the belt is on the loose pulley *E*, and, by means of a shipper, we move it on to *C*. This drives *D*, *F*, *J*, *H*, and the pawl *N* drives *K* at a slow speed.

If we move the shipper still further, the belt goes on to *A* and drives the shaft *X* direct. As *K* is keyed to *X*, this will turn both the ratchet *K* and the spring *L* in the direction of the arrow and move the pawl *N* (through the medium of the pin *P*2) out of gear with *K*, and the friction between *M M* and *K* will keep the stop *O* against *H*.

When the belt is put back on *C*, then *A* and *K* slow down, and when stopped or moving slower than *H*, then the spring *L* will rest against *P*1 and move it again into position, and the pawl will drive *K* and the shaft *X* at the reduced speed.

The face of *C* was about one-third that of *A* or *B*.

The device will doubtless be of general interest, and while not altogether unobjectionable, may be worthy of note by our friends who are in quest of hill-climbing gears for automobiles. "Q."

Lincoln Cathedral—Ancient Architecture—British Machine Trade.

Editor American Machinist:

There are few places so remarkable as the city of Lincoln. It is curious both by virtue of its position and of its history, though no doubt its history is the natural outcome of its position. The old city of Lincoln, in fact, stands at the end of a hill which rises steeply from the level of the fen lands at its base, and this fen land is, I have been told, only 15 or 20 feet above sea level. On the extreme end of the hill stood the old Roman city, and numerous traces of it have been found

from time to time. The principal thing left, which is said to have been built in the year 45, is the Newport, a Roman gateway, consisting of one arch spanning the cartway and a smaller arch at the side for foot passengers. This arch is now called the Newport Gate, the word gate being added as though already New port did not mean new gate. It is quite characteristic of things in this country, that when you come across anything that is called new it will prove to have been once new. Thus this Roman arch was new 1856 years ago, and, for anything there is wrong with it, may well look much as it does now when twice as old. The Roman city measured about 400 yards square, and contains the Norman Castle, built about 1068, upon some huge earthworks that are stated to have been of British origin. Thus each successive race occupied this site as one of its commanding citadels, owing to the very remarkable natural position and the command of the marshes below that it afforded. The Ermine Street ran through here on its way to Barton-on-Humber, and crossed another street at the middle of the city. The Danes left their mark here in 1017, but it was probably more destructive than constructive. The Danes had a good deal to do with the general settlement of the country, for Lincolnshire contains many places whose names end in "by" and "ey," or contain other indications of Scandinavian origin.

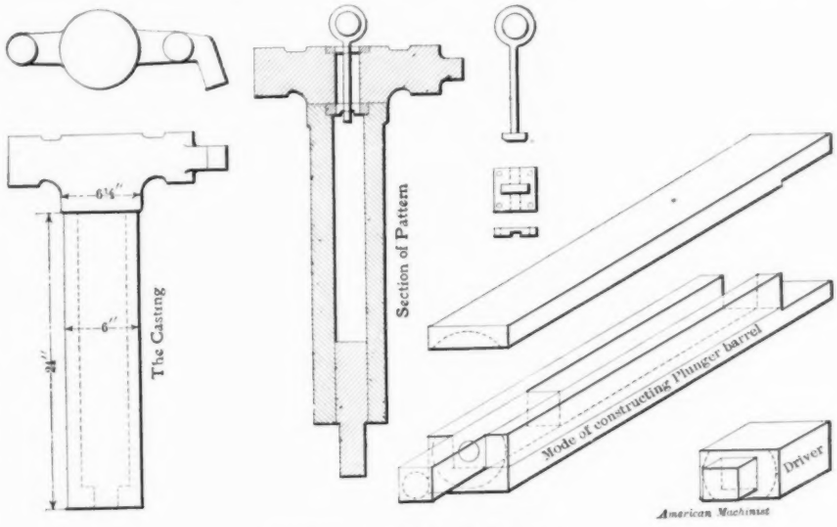
The chief interest of Lincoln to-day is its cathedral, built in the year 1080, and onwards, even as late as 1360. It is impossible to describe such a building as this. Its appearance changes with every step one takes around it, and the only thing one can say of it is that which occurs to me at so many of such buildings, that it is unequaled. It is something that has lived through fire, and even an earthquake, and still holds something of its founders' structure, now eight hundred years old.

It seems strange how the brains and the constructive ability of the period were all concentrated upon works of wood or of stone, and that these have come down to the present day in a sense more beautiful than they were when new, especially when compared with latter-day architecture, which is usually so painfully inappropriate and betrays evidence that architects now plan only from external appearance without any knowledge of structure. As an example of this, there is a granite arch in Fleet street, London, on the south side, close to Ludgate, which shows a shop entrance or shop front. It abuts on a pier quite incapable of carrying its thrust as an arch, thus showing concealed steel girders inside which carry the false arch. In an old cathedral the thrust of an arch, when taken on an insufficient column, is counterweighted by raising the column and putting a heavy pinnacle on top of it. I fear that if our works of construction to-day were left untended, to stand unpainted through the same period of neglect that the old cathedrals have endured, there would be no superstructure left, and only masonry foundations would tell a tale of what had been. The things that seem to endure through ages are earthworks and masonry. Earthworks especially stand good where covered with grass, and on Salisbury plain, about Stonehenge, almost every clump of trees contains an earthen tumulus still retaining its original conical form, as when heaped up, no one knows how long, before the Romans set foot here.

The whole area of the old city of Lincoln, parts of which are narrow streets almost two in three in steepness, is full of all manner of old buildings used and unused, many doing duty very different from what they were built to do; old monastic buildings becoming dwelling houses, and huge posts forming gateways to very inconsequential small houses. Once built they remain and pass through all stages. Though of limestone, the weight does not seem great, as is often the case with calcareous stones. For real durability, no stone comes up to the hard, carboniferous sandstone. Inscriptions on this stone look unchanged after 300 years out in the weather and fresh as the day they were cut.

The larger Roman archway is only 16 feet across, and there is another arch of mediæval age called the Stonebow, a sort of Temple Bar across the High street separating the upper city from the lower town. Through the lower town flows a river that drains the fen land, on which fens the Romans did a lot of work, constructing the Fosse dyke to drain it and building the Roman bank to keep back the sea.

The lower part of Lincoln is modern and may be termed the center of the agricultural engineering trade. Great numbers of portable engines are turned out here, and one of these engineering works —that of Ruston Proctor & Co.—manufactures steam excavators. In this part of the city the terms new or old obtain a very different signification when applied to machine tools, which get called old at twenty years or sooner, if something better is to be had, or should be so. It is depressing to find old machine tools at work. In fact, an old machine tool is as distasteful as a new building—I do not mean a new workshop, for these ought to be as new as possible. Probably the fitness of things fixes one's admiration of them, and in respect of new workshops there is a very considerable movement in progress in this country. Everywhere one finds new works going up. Some of the old works have become so very old that they are being abandoned entirely, even to the extent of moving to a different town, and thus the old works will soon be among the best and of course be absorbers of new machine tools.



MAKING A PLUNGER PATTERN.

My thanks are due to Senator Morgan for his recent neighborly speech about America's best customer. It is so novel and fresh to us. In this Old World country we do not possess enough originality to go about swearing destruction at our best customers, breaking their windows or threatening to go back on our engagements. If people only get to believe there are many Morgans in America, it will be a great help, no doubt, to us in selling lathes and other machines such as American makers are trying so hard to sell here at present. We have plenty of men like him over here, I am told, but they mostly live in places called asylums, and we don't call them senators. I should add that the tools we sell are made in Germany. I thank Mr. Morgan. May his tongue still wag. Americans living or doing business abroad will appreciate his wisdom.

W. H. Booth.

London.

Making a Plunger Pattern.

Editor American Machinist:

No doubt there are many ways of making a plunger pattern similar to the one shown in sketch, but we have found the way illustrated here a good one and it is standard in our shop. The yoke part or head of this pattern is carved from a solid block, with width and depth enough to work out the fillets where they die into the barrel. The barrel is glued up as illustrated, one end being cut out to take the yoke piece. Into this end is fitted the block marked "driver." The spur center is driven into the end of this block, opposite to the end shown; the projection on the end of the driver fits the inside of the barrel, and prevents it from slipping while the barrel is being turned.

The lifting iron is forged in a single piece of ¾-inch round iron, the tee being squared. This tee part slips through the oblong slot in the lifting plate and a half-turn allows the square tee to engage the recess in the under side of the plate, which prevents it from turning while the pattern is being drawn. The iron plate in the outside end of the plunger is to keep the lifting iron from marring the pattern, as the iron is made long enough to slip through the oblong hole in the yoke and engage the lifting plate below it.

The barrel is turned up the full length of the pattern. The driver is then removed and the lifting plate is recessed and screwed in place. Then the yoke with the oblong hole through it is glued and screwed in the end of the barrel from which the driver was removed, and the pattern is ready to be finished.

"Hobo."

American Agricultural Machinery Not Affected by Russia's Action.

Editor American Machinist:

I trust you will permit me to point out and rectify a slight mistake which has crept into an article which was published in issue No. 8, 1901, entitled "American Machinery Trade in Russia Crippled." The mistake in question was in stating that the increased duty charges now in force with reference to certain products of the United States of America applied to "agricultural machinery." After communicating with the United States Consul General here as well as the United States Embassy, I find that agricultural implements are not included in the list of articles subjected to the increased import duty.

Societe Anonyme Westinghouse,
Walter Phillips.

St. Petersburg, Russia.

Sale of Patent Office Models.

At the United States Patent Office, Washington, there is an accumulation of models of inventions received between 1887 and 1898, none of which have ever become a part of the records of the Office. All these models, and all models belonging to abandoned applications and to applications finally disposed of, will be sold at public auction at the Patent Office on May 22. A good opportunity to buy playthings cheap.

Foreign Trade Opportunities.

TOOLS FOR SIBERIA.

The administration of the Great Siberian Railway is building machine shops, foundries, and extensive repair shops all along the line. It has long been recognized that it will be out of question to import all the material required for the road from abroad, or even from European Russia, in the long run; hence the activity in establishing shops. A friend of mine, who is in Western Siberia at present, has just informed me that the Commercial Department of the Great Trans-Siberian Railway will be glad to receive catalogs on any tools and implements salable in Siberia. He adds that catalogs and descriptive matter should be sent to M. N. Selikhoff, Departément Commercial du Chemin de Fer Grand Sibérien, Tomsk, Siberia, Russia. It would, of course, be useless to submit any catalogs printed in English. Whenever possible, Russian catalogs, or at least French, should be sent; prices would best be quoted in francs, f. o. b., New York.

SCALES AND MACHINERY FOR BARCELONA.

The Harbor Administration of the port of Barcelona, Spain, invites bids for the supply of machinery, apparatus and material required for the construction and equipment of an extensive warehouse. The orders to be placed include loading appliances, conveying and power transmission machinery, thirty-two scales of various sizes, and an electric-light plant. Offers should be addressed at once to the "Junta del Puerto de Barcelona, Spain." The offers should be in either Spanish or French.

EARTHWORKING AND EXCAVATING MACHINERY, ITALY.

Some weeks ago a company styled as "Navigazione Fluviale Tra Venezia e Milano" was formed, with headquarters at Venice, Italy. The company is capitalized at 4,000,000 lire italiane, or about $800,000. The company will build a canal from Venice to Milan, thus establishing a waterway between Milan and the Adriatic Sea. The construction of this canal will doubtless create a demand for machinery required for such work.

RAILWAY MATERIAL, ETC., FOR INDO-CHINA.

A report from Paris is to the effect that the French Government has appropriated the amount of 10,394,000 francs for the construction of a railway to connect the port of Saigon with the Saigon-Mytho Railroad, and for the erection of twenty-five warehouses. It is stated that the city of Saigon is making steady progress, and that the new harbor works will soon be completed. The city has now a population of about 100,000, including suburbs. It is an important commercial center and has regular steamship communication with France. A new quay, 3,500 feet in length, is also to be built.

AGRICULTURAL IMPLEMENTS FOR ALGERIA.

There exists a lively demand for all kinds of agricultural machines and implements in Algeria. Colonization is extending all over the country, and the imports of machinery and implements during the year 1900 were far in excess of those of any previous year. H. L. G.

Operating Gas and Gasoline Engines—II.

BY HARRY J. PERKINS.

TESTING AND TROUBLES.

Care and attention must be given a gas engine to avoid trouble. The principal troubles are: (1) Gasoline pipe or vaporizer partially filled with dirt; (2) batteries weak, wire broken or short-circuited; (3) movable electrodes gummed, carbon or rust formed on ends of electrode; (4) leaky inlet or exhaust valve; (5) piston rings weak or worn out.

Before attempting to start, see that the gas bag is full of gas or that your gasoline tank is full. Don't *think* you know it, but know it by testing. See that the gas or gasoline reaches the engine. Notice if the valves work freely. Push them in with your finger; if sluggish, oil, or if gummed up, clean off with gasoline or kerosene.

Test the movable electrodes. If binding in the journals, loosen by kerosene; if that fails, take out and wipe the stem free from gum. (Movable electrodes should be removed and cleaned every week.) Test the spark by removing one wire, holding the two electrodes together and snapping the wire across any portion of the engine. If there is no spark, the cause may be that the switch is off, the batteries exhausted, wire broken loose from binding post, or carbon or rust has formed on the electrode. If the latter, brighten the ends of the electrodes with emery cloth or file. If the two electrodes are separated and you can produce a spark by snapping one end of the wire on the engine, there is a leak, and it must be remedied by removing the insulating plug and cleaning off the carbon or rust that has formed. Electrodes should have about ⅛ inch separation in cylinder.

If the engine fails to start, the cause may be the lack of a spark, lack of fuel, or too much fuel. Examine the igniter as directed, and see that the gas supply is correct. In cold weather gasoline does not vaporize readily, unless warm air is used or the vaporizer is kept warm. The vaporizer should be supplied with warm air from the engine after starting.

If the engine stops running, it may be

due to a weak spark on account of the battery giving out, or an improper mixture of gas and air; the water may not be turned on, the engine may not be properly lubricated with oil, or the piston or the bearing may have become overheated. In case of weak explosions, the fuel may be too rich or the reverse, the valves may leak or the inlet or exhaust pipes may be stopped up, the electric spark may have run down or the tube got too cold, or the ignition may be set too late. The charge should be ignited just before the piston reaches the top.

Back firing may be caused by a weak charge, too high compression or some thin projection of metal in the cylinder which acts as an igniter. Examine the cylinder and thoroughly clean out all carbon or other projection. If the engine pounds, there may be a loose bearing, the igniter may be set too early for the speed of the engine, or the engine may be too small for the power required, and cannot hold its speed on a load.

If there is a lack of power, the igniter may be set too late, the valves may leak, the piston rings may not be tight, the inlet or exhaust passage may be obstructed in some way, the relief valve open, or it may be overloaded. Too much cold water may be used; the exhaust water should be hot.

Smoke may be caused by an overheating of the piston, or the piston rings may need renewing, if the smoke appears about the piston. If the smoke is in the exhaust pipe, too much oil is being used, either lubricating oil or the gasoline, or a too rich mixture of gas is used. If the piston-head leaks, tighten up the bolts, and if this does not have the desired effect, put in a new gasket. Soft copper is best, smeared over with oil and flour of emery.

SOME DON'TS.

Don't use cheap cylinder oil or steam-engine oil on your engine.

Don't fail to oil your engine every time you run it, and clean it up when through running.

Don't fail to see that the water is flowing properly when the engine is running.

Don't allow water to remain in the water-jacket around the cylinder while the engine is idle on a cold day.

Don't forget to throw off the switch or disconnect the wire when through running.

Don't allow your gasoline vaporizer or pipe to get filled with dirt.

Don't keep your batteries or spark coil in a damp place.

Don't fail to examine your engine occasionally.

Don't make any changes on your engine or allow a so-called expert to change your engine.

Don't blame the engine at once if it don't run; look for the trouble, follow the instruction book—it may be your fault.

Don't look for gasoline leaks with a lighted lamp or match.

ENGINEERS.

Remember that every manufacturer tests by indicator or brake every engine before shipment, and each moving part is carefully adjusted and set. Leave the engine alone; never attempt to take the engine apart until you have run it a while and have become familiar with it unless absolutely necessary. Never take it apart from curiosity. Be sure and follow the instructions. An engine should be thoroughly overhauled every three months. When taking an engine apart, be careful and note the marks. If there are none, make them, so that the pieces may be returned to their former positions. It should be the pride of every engineer to keep his engine looking fine, by cleaning the outside every day, in particular all bright spots. The cylinder of an engine in constant use should be rebored every two or three years, and the rings should be removed as often as may be needed. All valves on the engine should be reground with flour of emery if they show the slightest wear. Carefully wipe them off before replacing.

Examine all springs; see if they are free from rust and gummed oil; occasionally look after your batteries, put both the batteries and the spark coil in a dry place. Use a waterproof No. 14 wire for making all connections. Pack a gasoline pump with soap and lamp wick, the water pump with oil and lamp wick. See that the exhaust and inlet passages are kept clean.

Remember that gasoline fires are easily extinguished with sand or earth, but if in an enclosed space it is more quickly extinguished by ammonia, which should be hung up in several half-gallon bottles in the engine room by a cord that will burn and where it would be easily broken by the fall.

Advice to President Schwab.

Our enterprising fellow-countryman, Mr. Charles M. Schwab, has had his salary raised. He has gone to work for the United States Steel Corporation in the capacity of president, and will receive about $15,386.54 every Saturday night, provided, of course, that his employers pay their help weekly. Mr. Schwab is but thirty-nine years old, and "Commerce, Accounts & Finance," with its customary interest in ambitious young men, takes this opportunity to offer him a few words of advice.

In the first place, Mr. Schwab should realize that he has now a good steady job at fair wages, and must do his best to keep it. He should avoid being late at the works in the morning, and should never run the risk of being docked. To be docked a day's pay would mean a loss of over $2,500, and that would go a good way toward paying the grocery bill. He should not take more than an hour's nooning and should be respectful to the directors when they speak to him. If he feels that his salary is low for the amount of work done, he should remember that it is customary to begin rather low and work up, and when he knows more about the business he can ask for a "raise." Besides, salary isn't the only thing.

Be economical, Mr. Schwab. So many young men nowadays live beyond their means. Don't pay too much house rent. The rule which says that a man's rent should never exceed one-fourth of his salary is a good one. You should be able to hire a nice, comfortable house for $200,000 a year and the water rate. Perhaps you can do even better than this in your town, where rents are, in all probability, low. The building and loan associations are helps to young men who wish to own their own houses. Don't build too expensive a house, however.

Live well, but not luxuriously. Have plenty of plain, wholesome food, and not many expensive puddings and desserts. A soup or stew followed by a baked Indian pudding or a cornmeal mush makes a good dinner. Don't have too much company, and use lamps instead of gas for lighting purposes. Pay your bills every week, and don't buy goods on the installment plan. It would not look well, in case the directors of the steel company were calling at your house to have the furniture people come and carry off the plush parlor set for non-payment.

Your new position will naturally call for increased social obligations, and you should meet them cheerfully. Mrs. Schwab should keep a servant. For a few hundred dollars a week one of the Pittsburgh girls would, doubtless, be willing to come in and do housework. Buy a good black suit for best, and see that Mrs. Schwab has at least one calling dress and a Sunday gown and bonnet.

But, above all, save money. Mr. Russell Sage recently said that a young man should save a quarter of each dollar he earned. If you did this you would have, at the end of the year, $200,000 put by for a rainy day. In a few years you would thus be able to stand quite a spell of wet weather.

So, Mr. Schwab, "Commerce, Accounts & Finance" bids you go on and prosper. We have great hopes of you, and believe that, with economy, you will have no trouble in keeping out of the poorhouse. Do not let anything we may have said lead you to believe that we consider your salary a meager one. You are getting good wages. In fact, we know editors, great leaders of thought, who get no more for their services than you do for yours.—"Commerce, Accounts & Finance."

Personal.

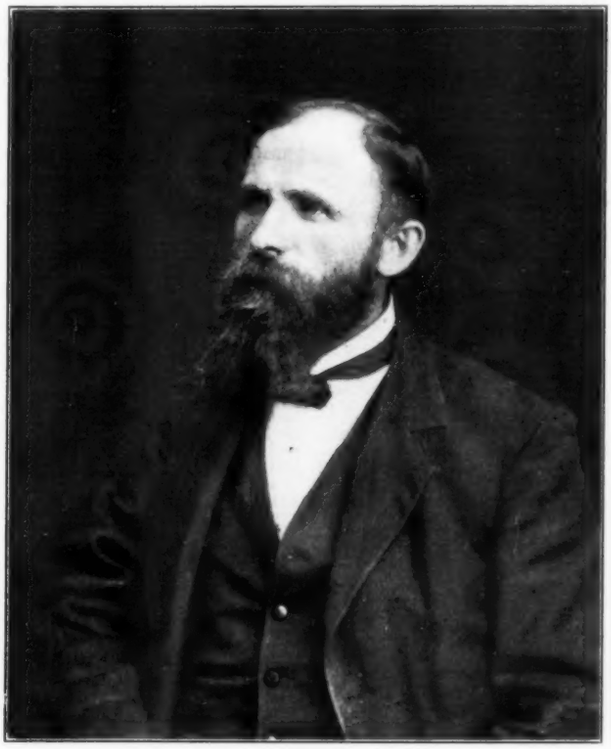
Frank E. Barnard has retired from the firm of B. M. Jones & Co., of Boston.

Edward H. Cox, A. M. I., M. E., who for the past five years has been with

the De La Vergne Refrigerating Machine Company, in the commercial department of the business, has resigned his position. His present address is P. O. Box 1699, New York city.

Obituary.

William B. Reaney, a marine constructor and consulting engineer, died in Philadelphia, March 27, sixty-eight years old. His father was head of the well-known shipbuilding firm of Reaney, Neafie, Levy & Co. The son learned the business in the works, and when twenty-four years old he built the ship "Lancaster." He became a member of the firm of Reaney, Son & Archibald, of Chester, Pa., later the John Roach firm, and constructed several monitors for the United States Navy. He later was connected with the Columbia Iron Works & Dry Dock Company, of Baltimore, and acted as an unofficial consulting engineer for the Pennsylvania Railroad. He retired from active business five years ago.



ULRICH EBERHARDT.

Ulrich Eberhardt.

Ulrich Eberhardt, head of the well-known tool-building firm of Gould & Eberhardt, Newark, N. J., died March 31, fifty-nine years old. Mr. Eberhardt was a native of Switzerland, and came to this country with his father and family in the early fifties, settling in Newark. He was at once put to work, first at stripping tobacco, getting an education in the evening schools. His next job was running an engine at the Ward Rule Works. As soon as he was old enough, he was apprenticed as a machinist to Ezra Gould. He made such rapid progress that before he had reached his twenty-first year, and while still an apprentice at $3.50 per week, he was foreman of the shop. Shortly after reaching his majority, he was taken into the firm, and in 1890 he acquired the entire control of the business. A short time ago the firm was incorporated, Mr. Eberhardt becoming president of the company and retaining a controlling interest. Mr. Eberhardt's entire business life was thus given to the one concern, and it is the monument of his untiring effort and ambition. He was always at the works until his final illness, and always scheming for the improvement of his output and the extension of his business. The firm has a world-wide reputation as builders of good machine tools. Their earlier specialties were upright drills and shapers, but later automatic gear-cutting machinery has been a prominent feature. An extensive foreign trade has been developed and the entire works have recently been rebuilt and enlarged. Mr. Eberhardt took a deep and genuine interest in the personal welfare of his men, and especially helped along the younger employees. His foremen and old employees have largely been developed in the works. No strike or labor trouble was ever experienced by the firm. Mr. Eberhardt's only brother is still connected with the works, and his two sons will continue in charge of the business.

Geo. W. Kelly & Lewis, engineers, 560 Bourke street, Melbourne, Australia, inform us that they would like to receive catalogs of labor-saving and other machine tools, including those used in boiler making.

Indications seem to point to the abandonment of the welded link chain. We have lately noted the establishment of a large plant in England for casting chain, and now two United States patents have been issued to a German inventor for a method and a machine for making chain from rolled bars of "cross-iron."

New Catalogs.

T. B. Wood's Sons, Chambersburg, Pa., have published catalog No. 12, of 156 pages, showing power-transmitting appliances, such as shafting, couplings, pulleys, hangers, friction clutches, belt tighteners and rope transmission. Size, 4½x7 inches.

We have received a pamphlet containing a description of the electrolytic laboratory of the University of Pennsylvania, by A. Wm. Schramm. It tells about the outfit, electrical connections, etc., of this well-arranged laboratory, and is printed on pages 5¾x9 inches in size.

We have received a 1901 catalog of the Worcester (Mass.) Polytechnic Institute. There are regular courses in mechanical, civil and electrical engineering, chemistry and general science. An interesting department of this school is the extensive Washburn shops. Size of page, 5¾x8½ inches.

The E. W. Bliss Company, Brooklyn, N. Y., has sent us a pamphlet showing some Stiles power punching presses, plain and with automatic cam stripper and double roll feed, with tube feed, etc.; watch and clock makers' power press; sprue cutters; bit-heading press, etc. Size of catalog, 5x7¼ inches.

The Lufkin Rule Company, Saginaw, Mich., has published catalog No. 6, in which are shown steel and linen measuring tapes in great variety, folding steel rules, circumference rules, steel and hickory board rules, log rules, log calipers, "Magic" pattern rule for sheet-metal workers, glass cutters' board, etc. It is 6x9 inches, standard size.

The Franklin Machine Works, 439-443 North Twelfth street, Philadelphia, Pa., have sent us a catalog intended to give some idea of the numerous sorts of machinery they manufacture. The machinery shown is broadly summarized as printing and paper-cutting, but includes such types as paper-bag and match-box making machines. Size of catalog, 6x9 inches, standard.

H. W. Caldwell & Son Company, Western avenue, Seventeenth to Eighteenth streets, Chicago, Ill., has published catalog No. 25 of elevating, conveying and power-transmitting machinery. It is a cloth-bound book 5½x7½ inches, and containing 441 pages devoted to an assortment of apparatus which it would be hopeless to attempt to enumerate in detail. The company's helicoidal conveyors of course play a prominent part.

The Lawrence Machine Company, Lawrence, Mass., has published a catalog of improved centrifugal pumping machinery with double swivel suction and discharge pipes. These pumps are built for belt driving or directly connected to engine or motor, and also in portable form with engine and boiler. They have proved especially popular in paper mills and other industrial establishments. The catalog is 5¼x8 inches.

The Kempsmith Manufacturing Company, Milwaukee, Wis., has sent us a number of catalog sheets showing milling machines, as follows: Nos. 0, 1 and 2 universal, Nos. 1½, 2½ and 9 plain back geared, No. 2 plain rack feed, No. 2 plain screw feed, No. 5 double back geared, No. 10 hand, No. 12 plain geared, also vertical spindle milling attachment for No. 2 universal and No. 2½ plain, universal dividing heads, etc. Size of pages, 5¾x8¾ inches.

From the Sprague Electric Company, 527-531 West Thirty-fourth street, New York, comes its catalog No. 404 (6¾x9 inches), describing an extensive line of interior conduits, iron-armored, brass-armored and unarmored, flexible metallic conduits, armored cables, conduit fittings, special tools, etc. Another pamphlet (7x9¼ inches) it has sent us describes some of its round-type motors; octagon-type, four-pole motors for automobile service, etc. Still another (7x9¼ inches) relates to Lundell fan motors.

The Baldwin Locomotive Works, Philadelphia, and the Westinghouse Electric & Manufacturing Company, Pittsburgh, have published an attractive pamphlet describing in considerable detail a system of electric locomotives for mine haulage, which they build jointly. The Baldwin Locomotive Works also send us "Record of Recent Construction, No. 22," giving views and dimensions of steam locomotives recently built by it for several American roads and for the Bavarian State Railways. Each pamphlet is 6x9 inches, standard size.

The Garvin Machine Company, Spring and Varick streets, New York, has issued a new catalog of metal-working machinery manufactured and sold by it. The company's own lines include milling machines of several types, drill presses with one to ten spindles, profilers, hand lathes, turret lathes, screw machines, tapping machines, gear cutters, screw slotters, cutter and surface grinders, wire coilers, milling cutters, die slotters, automatic and special machinery. These, with the tools for which the company holds agencies, give it a wide scope, and a good selection of the tools is shown in the present catalog. It is 8¼x11 inches.

Manufacturers.

The East End flint mill, East Liverpool, O., is being enlarged.

A fertilizer factory at Savannah, Ga., is proposed by Charles Ellis and others.

John F. Riley, of Charleston, S. C., will, it is reported, rebuild his machine shop.

D. A. Hudson and others are organizing a company to build a cotton mill at Gaylesville, Ala.

Fred Eddy and Edwin Carrington, West Bay City, Mich., will erect a large box factory.

The P. Hohenadel, Jr., Company is being organized to build a canning factory in Janesville, Wis.

The Fiberloid Company, Newburyport, Mass., manufacturer of collars, etc., will build a new factory.

David E. Makepeace, Attleboro, Mass., is taking steps to erect a jewelry factory, 153x81 feet, three stories.

The Niagara Electro-Chemical Company, Niagara Falls, N. Y., will more than double the size of its plant.

The Columbus (Ga.) Iron Works Company will erect additional foundry and increase capacity of its plant.

The sawmill and planing mill of C. Reindell, in Wheatland township, near Deckerville, Mich., has been burned.

(*Continued on next page.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 24.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Parallel drawing-board attachments; by mail, $1.50; circulars. F. G. Hobart,Beloit,Wis.

Light and medium patterns and machinery built to order. W. L. Mead, South Orange, N. J.

Wanted—Second-hand machinist's bench lathe with draw-in chucks, etc. Box 444, AMERICAN MACHINIST.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

For positions in charge, or competent men for such positions, address James Brady, 220 Broadway, New York City.

Wanted for Export—Machinery for the manufacture of twist drills. Address "Export," care AMERICAN MACHINIST.

Wanted to Manufacture.—A specialty to manufacture in cast iron, requiring little or no machining, is desired. "Pennsylvania," care AMERICAN MACHINIST.

Wanted to Exchange—Automatic screw machines from ⅜ to 2 in. capacity for 14 to 16 in. engine lathes and hand screw machines taking larger than 2 in. stock. The Peerless Mfg. Co., Cleveland, O.

For Sale—Complete editions "American Machinist" from Jan. 1, 1886, to date; papers from April 6, 1899, to April 4, 1901, loose; balance bound in paper covers. Address Hugo Momm, 557 Fulton st., Elizabeth, N. J.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale—Foundry equipment, complete, $600; including 3-ton cupola, 100 ft. 12 in. blower pipe, new Root No. 5 blower, engine, 20 H. P. portable boiler and smokestack, 75 ft. shafting, pulleys, hangers, belting, 25 ladles, rattle boxes, emery wheel piping, 200 floor flasks, bottom boards, clamps, Jogers snap flasks and bottom boards, 5 tons snap weights, snap boxes, molding shovels, riddles and tools, molding benches, odd patterns, core boxes, core plates, drill press, pipe tools (¼ to 4 in.), portable forge anvil, saw bench, stoves, scales, vises, 5 tons scrap iron, fireclay and facing, etc.; just the thing for country shop. Address L. L., care AMER. MACH.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman wishes position. Address Box 13, AMERICAN MACHINIST.

Capable draftsman wishes position; technical education; first-class machinist. Box 441, AMERICAN MACHINIST.

An experienced foreman on engines and general machine shop work desires position. Box 9, AMERICAN MACHINIST.

A young draftsman, engineer, Swede, just now coming over, desires position. Birger Janson, 201 E. 28th st. (care Olason).

A first-class designer wishes to make change for New York city; experimental work preferred. Address Box 7, AMER. MACHINIST.

Machinist, toolmaker and draftsman, experience as foreman and general foreman, desires change. Box 17, AMER. MACHINIST.

Position as foreman of screw machine or turret department; 15 years' experience, 8 years as foreman. Address Box 18, AM. M.

Having left my former position, I should like to hear from parties wishing a competent iron foundry superintendent or foreman. Box 416, AMERICAN MACHINIST.

Expert on gas engines and automobiles, college graduate, good practical experience, open for position as chief engineer or chief draftsman. C. D., care AMER. MACHINIST.

Foreman with 11 years' service at present location on high-grade engine work, is desirous to correspond with parties looking for a hustler; reference. Box 12, AMER. MACH.

Mechanical engineer, resourceful, inventive, accustomed to designing special tools, and up to date in shop practice, open for position May 1. Address Box 8, AMER. MACHINIST.

Advertiser, at present chief mechanic and millwright with firm in Argentine Republic, would represent manufacturers of up-to-date American appliances, tools and supplies. Address Box 15, AMERICAN MACHINIST.

Up-to-date cost clerk and factory accountant wants position; knows shop methods; can organize and direct factory systems; now employed, but dissatisfied; new plant in West preferred. "Experienced," care AMER. MACH.

An American man, married, best character, with energy and ability, 20 years' experience designing and building machine tools and special machinery, desires position as assistant superintendent or of trust; East preferred. Box 10, AMERICAN MACHINIST.

Mechanical engineer, owning patents and drawings of an internal combustion engine, desires position with engine builder who will manufacture same for the blast furnace producer and natural gas trade on a royalty. Box 11, AMERICAN MACHINIST.

Mechanical engineer, first-class, energetic man, college graduate, good pratical experience, expert on gas engines and automobiles, is open for position as manager, chief engineer or chief draftsman. Address Sumner H. Doulton, 66 Broadway, New York.

Situation as superintendent or assistant, by a practical man; 15 years' experience on small parts, such as typewriters, etc.; can design tools; understands modern methods and economical production; only those who believe in system need write. Box 16, A. M.

Mechanical engineer, first class and up to date, desires position as general manager, superintendent or mechanical engineer; technical graduate in both mechanical and electrical engineering; thoroughly practical and competent; age 30; best of references. Box 14, AMERICAN MACHINIST.

Help Wanted.

Wanted—Experienced diemakers. Address Stanley Electric Mfg. Co., Pittsfield, Mass.

Wanted—Draftsman of experience in an engine works in Ohio. Address Box 434, AM. M.

Wanted—A1 draftsman, familiar with Corliss and air-compressor work. Box 19, A. M.

Wanted—Die-sinkers, first class, for forge dies; automobile work. Address Box "P," Toledo, O.

Wanted—Brass molder, thoroughly competent to mix as well as mold. Address Bundy Mfg. Co., Binghamton, N. Y.

Wanted—Machine tool salesman for old-established house; young man with technical education preferred. Address Box 439, AM. M.

Wanted—Two or three mechanical draftsmen for general work. Address, with full particulars, Stanley Electric Mfg. Co., Pittsfield, Mass.

Wanted—Experienced turret lathe operators; give references, experience and wages expected. American Turret Lathe Co., Wilmington, Del.

Toolmakers, patternmakers and general machinists wanted for new shop in city of 80,000, located central New Jersey. Box 21, AMERICAN MACHINIST.

Experienced draftsman, by a concern in Ohio, manufacturing hydraulic machinery and air compressors; give age and references. Box 3, AMERICAN MACHINIST.

Experienced operators for forging machines and bulldozers for blacksmith shop department, also machine hands for machine shop. Box 5, AMERICAN MACHINIST.

Wanted—Machine tool salesmen for Pittsburgh and vicinity; must be capable, energetic and steady; good situation for right parties. Particulars, Box 6, AMER. MACH.